NUCLEAR SCIENCE ABSTRACTS

Volume 11 October 31, 1957 No. 20

GENERAL

ATOMIC BOMBS AND WARFARE

11013 NP-6387
Engineer School Library Fort Belvoir, Va.
NUCLEAR WARFARE. A Bibliography [Covering the Period] June 1955–June 1956. Nov. 1956. 99p.

ATOMIC POWER

11014 NP-6358
Organization for European Economic Co-Operation, Paris.
NUCLEAR POWER STATIONS — PROPOSALS FOR THEIR CO-OPERATIVE DEVELOPMENT IN EUROPE. May 1957. 34p.

11015
ATOMIC POWER — FEAR AND HOPE. THE NATURE OF NUCLEAR ENERGY AND THE POSSIBILITIES OF ITS APPLICATION. Engelbert Broda. Vienna, Globe Publishing House, 1956. 264p. (In German)

RESEARCH PROGRAMS

11016 AEC-tr-2925
ALL-UNION CONFERENCE ON THE APPLICATION OF RADIOACTIVE AND STABLE ISOTOPES IN THE NATIONAL ECONOMY AND SCIENCE. (ABSTRACTS OF PAPERS AND PLENARY SESSION PAPERS). Translated from a publication of the Academy of Sciences U.S.S.R., Moscow, 1957. 460p. $2.20(OTS).

Abstracts are presented of papers presented at a conference on applications of stable and radioactive isotopes in the national economy and science in the U.S.S.R. Topics discussed include: isotope production and high-intensity γ systems; industrial and technical uses of isotopes; uses of isotopes in biology, medicine, and agriculture; and radiation chemistry. Papers included in their entirety cover the following topics; applications of radioactive methods in prospecting and developing useful minerals; the use of nuclear radiation for automation and technological process control; the effects of small radiation doses on living organisms; the use of radioactive isotopes in clinical medicine; and applications of isotopes and radiations in agronomy. (C.H.)

BIOLOGY AND MEDICINE

11017 UR-491
Rochester, N. Y. Univ. Atomic Energy Project.
PATHWAYS AND RATE OF HEMOGLOBIN CATABOLISM DURING EXPERIMENTAL HEMOGLOBINEMIA IN SWINE. A. J. Emery, Jr. and H. W. Bales. May 20, 1957. 50p. Contract W-7401-Eng-49. $1.50(OTS).

AEROSOLS

11018 CWLR-2136
Chemical Warfare Labs., Army Chemical Center, Md.
EFFECT OF WIND VELOCITY AND PARTICLE SIZE ON NASAL PENETRATION OF AEROSOLS. Gabrielle Asset, Williams Farnum, and Stella Ryan. July 2, 1957. 17p.

Dead dog heads were exposed, in a wind tunnel, to three aerosol clouds to determine how particle size and wind velocity affect the amount of aerosol which passes through the nasal passages of experimental animals. One aerosol cloud consisted of spherical particles of 1.3μ moving at a speed of 2.5 mph and the two others, of particles of 7.6μ moving at 2.5 mph and 10 mph. Nasal penetration was determined on the basis of the aerosol concentration entering the nostrils and not that of the free airstream. (auth)

RADIATION EFFECTS

11019 AECU-3522
Utah. Univ., Salt Lake City. Radiobiology Lab.
ANNUAL PROGRESS REPORT. Mar. 31, 1957. 177p. Contract AT(11-1)-119. $27.30(ph OTS); $8.10(mf OTS).

Progress is reported in studies on the long-term toxic effects of radioactive heavy metals in dogs. Data are included on the pathological effects, metabolism, and bone deposition of Pu^{239}, Ra^{226}, Ra^{228}, Th^{228}, and Sr^{90}. Abstracts of papers to be presented at scientific meetings and a list of publications during the period are included. (For preceding period see AECU-3418.) (C.H.)

11020 AF-SAM-57-34
Kansas. Univ., Kansas City. School of Medicine, and School of Aviation Medicine, Randolph AFB, Texas.
EFFECTS OF IONIZING RADIATION ON ANAPHYLACTIC SHOCK IN THE MOUSE. Single Whole-Body X-irradiation of 300 Roentgens. Perry Morgan, Noble Sherwood, Alvar A. Werder, and Karl Youngstrom. Aug. 13, 1956. 19p.

Effects of 300-r whole-body x irradiation on anaphylactic shock were studied in CFW mice. Response measures were mortalities and changes in rectal temperatures. Mice received one x ray exposure 1/12 to 14 days before or 2 to 28 days after sensitization. Effective sensitizing dose was 0.2 ml. of water-in-oil emulsion containing killed Mycobacterium butyricum and 0.1 mg. bovine albumin. Intravenous challenge of nonirradiated mice with bovine albumin 10, 14, 21, or 28 days after sensitization killed 15, 16, 43, and 67%, respectively. X irradiation given 1/12, 2, 4, 6, or 8 days before sensitization lessened anaphylactic sensitivity in mice challenged 10 days postsensitization. Exposure to x rays after sensitization enhanced the reactivity. Challenges 10, 14, 21, or 28 days postsensitization of mice x irradiated at times between 1/12 to 9 days before challenge resulted in 36, 70, 76, and 84% mortalities, respectively. (SAM abst.)

11021 ORO-163
Tennessee. Univ., Knoxville.
AGRICULTURAL RESEARCH PROGRAM. Semi-Annual Progress Report for July 1, 1956 to December 31, 1956. 89p. Contract AT-40-1-GEN-242. $0.50(OTS).

Progress is reported on the following studies: nutritional factors influencing the excretory pattern of Cs^{134}, K^{42}, and Rb^{86} in rats; the influence of some hormones on Cs excretion; the influence of dietary K on the retention of Cs^{134} in swine; the metabolism of Cs^{134} in rabbits; factors influencing the relative uptake of Ca^{45} and Sr^{89} in rats; the effect of

vitamin D upon bone mineralization of Cs^{45} and Sr^{89} as chlorides and as phosphopeptides; the physiological behavior of Ca in rats; the absorption, excretion, and tissue distribution of ingested C^{14}-labeled diethylstilbestrol in lambs; some physiological effects of stilbestrol upon ruminants; radiation effects on sperm physiology in sexually mature bulls; the effects of extended exposure to external γ irradiation on swine and burros; and the effects of external whole-body irradiation on vitamin B-12 deficient rats. A summary of accomplishments at the plant and seed irradiation facility is included. (For preceding period see ORO-160.) (C.H.)

11022 ORO-168
Medical Coll. of Virginia, Richmond.
AN INVESTIGATION OF CERTAIN TISSUE PROTEIN CHANGES IN IRRADIATED ANIMALS. Progress Report for April 1, 1956–March 31, 1957. Henry G. Kupfer and Nelson F. Young. 13p. Contract AT(40-1)-1625. $3.30 (ph OTS); $2.40(mf OTS).

Preliminary results are reported from studies on the occurrence of bleeding tendencies and hyperheparinemia after irradiation, ways of preventing this tendency, a study of decreased immunologic activity and efforts to normalize this, and radioinduced changes in protein metabolism in rabbits. (C.H.)

11023 PB-121961
North American Aviation, Inc., Los Angeles, Calif.
LOGISTIC AND ECONOMIC FEASIBILITY STUDY ON RADIATION STERILIZATION OF FOODS. Final Report No. 6 [for] June 28, 1955–August 28, 1956. R. J. Beeley, J. C. Dillon, R. J. Mikell, C. O. Reiser, and E. C. Turner. 107p. Project No. 7-84-01-002. Contract DA19-129-QM-491.

A summary is given of the survey made of various radiation sources to determine the most economic radiation sources for large scale radiation processing. The sources considered included the spent reactor fuel elements, the fission product gases from a fluid fuel reactor, separated fission product Cs^{137}, reactor coolant Na^{24}, neutron-activated In^{116m}, charged-particle accelerators, and x rays. (R.V.J.)

11024 USNRDL-TR-142
Naval Radiological Defense Lab., San Francisco.
THE COMPARATIVE RESPONSE OF DOGS TO 250 KVP AND 100 KVP X RAYS. E. L. Alpen, D. M. Jones, H. H. Hechter, and V. P. Bond. Jan. 14, 1957. 25p. Project NM 006-015. (AFSWP-1025).

The relative biological effectiveness of 250 kvp and 100 kvp x rays has been compared in dogs. The LD_{50} is 280 r for 250 kvp and 664 r for 100 kvp measured in air. Various methods of correcting this dose to explain the differences in effectiveness are described. (auth)

11025 AEC-tr-2951
THE BONE MARROW STRUCTURE IN RATS AFTER IRRADIATION BY FAST ELECTRONS. M. Theodor Fliedner, S. Sandkühler, and R. Stodtmeister. Translated by N. Willis from Z. Zellforsch. u. mikroskop. Anat. 43, 195-205(1955). 8p.

11026 AEC-tr-2961
THE INFLUENCE OF IONIZING RADIATION ON ANTIBODY FORMATION. V. L. Troitskii (Troitsky), O. V. Chakhava and N. A. Kozlova. Translated from Med. Radiol. 1, 49-59(1956). 12p.

11027 AEC-tr-2964
AN IMMUNOLOGICAL ANALYSIS OF THE STATE OF INCREASED RESISTANCE OF THE ORGANISM TO IONIZING RADIATION. P. N. Kiselev, P. A. Buzini, and K. I. Nikitina. Translated from Med. Radiol. 1, 43-9(1956). 10p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-9049.

11028 AEC-tr-2979
THE INFLUENCE OF REPEATED IRRADIATIONS WITH SMALL X-RAY DOSES ON THE FORMATION OF IMMUNITY AGAINST TYPHOID FEVER BACTERIA. O. V. Chakhava. Translated from Med. Radiol. 2, 29-32(1956). 5p.

The stimulation of antibody production upon immunization begun a week after the end of repeated total irradiations with small x-ray doses is noted. Antibody titers in rabbits immunized during the period of radiation action did not substantially differ in value and dynamics from control titers. The repeated total irradiation of mice with small x-ray doses depressed their natural immunity. The vaccination compensated for the lowering of the natural immunity as a result of irradiation, and created an immunity more highly expressed than the natural immunity of the nonirradiated animals. Animals, repeatedly irradiated with small doses, were able to respond to the vaccination produced by active immunity, even though yielding in intensity to the post vaccination immunity of the nonirradiated animals. (auth)

11029 AEC-tr-2993
THE PATHOGENESIS OF ACUTE BONE MARROW ATROPHY. R. Stodtmeister, S. Sandkuhler, and T. Fliedner. Translated by B. Smith from Deut. med. Wochschr. 81, 964-5(1956). 6p.

11030 AEC-tr-2997
COMPARED INACTIVATION OF E COLI B BY ORGANIC PEROXIDE AND UV RADIATION WITH SPECIAL REFERENCE TO HEAT AND PHOTO-REACTIVATION. Von Werner Stein and Wolfgang Laskowski. Translated from Z. Naturforsch. 11b, 643-53(1956). 28p.

11031
MECHANISM OF THE DELAYED OCCURENCE OF DEATH AFTER TOTAL BODY IRRADIATION. Arthur C. Upton, Charles C. Congdon, and Alexander Hollaender (Oak Ridge National Lab., Tenn.). Atompraxis 3, 1-6(1957) Jan. (In German)

11032
ON THE EFFECTS OF PENETRATING RADIATION ON THE NERVOUS SYSTEM. D. A. Biryukov (Leningrad Inst. of Experimental Medicine). Fiziol. Zhur. S.S.S.R., 636-4(1957) July. (In Russian)

Experiments with pigeons and fowls showed that irradiation seriously injured the subcortical cerebral structures impairing the motor activity of the animals. The conditioned reflexes were not greatly affected. Irradiation of the fowl heads counteracted cataleptic inhibitions which also originate at lower cerebral levels. Correlation of facts suggested that irradiation injuries originate primarily in the lower cerebral levels. (R.V.J.)

11033
RATE OF ENTRY OF RADIOACTIVE STRONTIUM INTO PLANTS FROM SOIL. R. Scott Russel and G. M. Milbourn (Agricultural Research Council Radiobiological Lab., Compton, Nr. Newbury, Berks). Nature 180, 322-4(1957) Aug. 17.

11034
X-RAY INACTIVATION OF YEAST AT FREEZING TEMPERATURES. Thomas H. Wood and Austin L. Taylor (Univ. of Pennsylvania, Philadelphia). Radiation Research 7, 99-106(1957) Aug.

The radiosensitivity of haploid yeast irradiated in the frozen state decreases as the temperature is lowered in the range from 0° to –33°C by a factor of 2.5. As the irradia-

temperature is further lowered from –33° to –72°C, however, the radiosensitivity increases to the value typical of 0°C. Yeast slowly cooled to –72°C displays the radiosensitivity characteristic of –33°C. Cells prefrozen at –72°C and then irradiated at –50°C display the sensitivity typical of –72°C; cells prefrozen at –72°C and then irradiated at temperatures higher than –50°C show a decreased sensitivity. An explanation is made of the phenomena in terms of the rate of freezing typical of the several temperatures. At temperatures down to –33°C slow freezing occurs, and the cell is probably dehydrated by the freezing process; at lower temperatures freezing is rapid and a radiobiologically significant portion of the cellular water may be frozen within the cell. The effectiveness of inactivation by free radicals trapped in the ice during irradiation may depend on the temperature during irradiation and on the position of these free radicals on thawing, whether within or without the cell wall. (auth)

Refer also to abstracts 11082 and 11087.

RADIATION HAZARDS AND PROTECTION

11035 AECU-3516

Du Pont de Nemours (E. I.) & Co. Savannah River [Lab.], Augusta, Ga.

INTEGRITY OF A PLASTIC SUIT IN TRITIUM ATMOSPHERES. R. W. Van Wyck and H. L. Butler. Jan. 14, 1957. 11p. Contract AT(07-2)-1. $3.30(ph OTS); $2.40 (mf OTS).

The integrity of a plastic suit in tritium-contaminated atmospheres was determined. At contamination levels ranging from 10,000 to 100,000 times NPC levels, the level inside the suit is about 0.3% of the exposure level. Above this range, permeability of the suit increases rapidly. Penetration of the suit involves a time lag which offers protection against sudden bursts of activity. (auth)

11036 AFSWC-TN-56-2

Air Force Special Weapons Center, Kirtland AFB, N. Mex.

SAFE LEVELS OF CONTAMINATION FROM FISSION PRODUCTS. James L. Dick, William R. Hurdlow, and Ellen M. Hippeli. Apr. 27, 1956. 29p. Project 7801.

The radiation hazard resulting from fission product contamination of aircraft, aircraft parts, and airbase facilities can be classified as being an external and/or an internal hazard. The external hazard can be determined using a gamma survey instrument and film badges. However, the internal hazard constitutes a more complex problem, in that the measurements must be interpreted in terms of the age of the mixed fission products to establish the true magnitude of the hazard. As a result of this approach, higher contamination levels than those given in present USAF publications are proposed within the limits of current adopted national standards of radiation tolerance. Air sampling is the recommended method for determining the existence of an internal hazard. Limits of external and internal radiation levels are recommended for those items of materiel which may be released for general usage. Also recommended are limits for items kept in a controlled area, dosage limits for personnel working in such an area, and limits applicable to emergency situations. (auth)

11037 HW-42030

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DECONTAMINATION OF HUMAN SKIN AFTER IMMERSION IN A PLUTONIUM SOLUTION. R. H. Wilson. Mar. 30, 1956. Decl. July 9, 1957. 31p. W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

Various decontamination techniques, their results, and significant observations made during the period of decontamination are presented. The concentration of Pu was estimated to be 30 to 50 mg per mm of solution. Bioassay data include urinary excretion results through 31 days of sampling and results of a few fecal, blood, and tissue samples. Interpretation of the results indicates a body deposition of $\sim 1.2 \times 10^{-3}$ μc (3% of maximum permissible limit) of Pu. (auth)

11038 WAPD-PWR-CP-2428

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

REMOVAL OF RADIOIODINE FROM PWR PLANT CONTAINER AIR. A. S. Kesten. [Sept. 26, 1956]. 12p. $3.30(ph OTS); $2.40(mf OTS).

The effectiveness of Chemical Warfare Service filters and of filter-type air monitors was tested for the removal of radioiodine from air streams. The test apparatus simulated the chemical environment expected in the event of leakage of primary coolant from the Pressurized Water Reactor. (C.H.)

11039 WT-1182

Division of Biology and Medicine. Radiation Instruments Branch, AEC.

UTILIZATION OF TELEMETERING TECHNIQUES IN EVALUATING RESIDUAL RADIOACTIVE CONTAMINATION. Richard W. Johnston. Nov. 1956. 24p. Project 30.2 [of] OPERATION TEAPOT. $0.25(OTS).

A gamma-radiation telemetering system is described which was utilized to measure fall-out levels at the Nevada Test Site from the vicinity of Ground Zero out to, and including, an area bounded by Reno, Nev.; Salt Lake City, Utah; Kingman, Ariz.; and Baker, Calif. Three modes of signal transmission were used; direct-coupled field lines for on-site installations, vhf radio for close-in off-site measurements, and commercial telephone lines for areas out to 350 miles. The communities covered by the telephone telemetering stations received no significant fall-out except in one instance where the level exceeded 20 mr/hr. Data on all fall-out measurements are presented, and recommendations for improvements of the system are made. (auth)

11040 AEC-tr-2947

OBSERVATIONS ON RADIOACTIVE CLOUDS FROM THE ATOMIC BOMB TESTS FOR THE YEARS 1953/1954. A. Sittkus. Translated from Naturwissenschaften 42, 478-82(1955). 11p.

11041

AIR TREATMENT IN ACTIVE LABORATORIES. C. Fisher and A. V. Bestre (Matthew Hall & Co. Ltd.). Nuclear Power 2, 311-14(1957) Aug.

General considerations in design and construction of air treatment facilities for "hot" labs are discussed. Filters, fans, and seals are considered, and the special cases of glove boxes, hot cells, and chemical separation are treated. (T.R.H.)

11042

AN ELECTROSTATIC FILTER FOR ATOMIC ENERGY PLANTS. M. D. Penrose and F. P. Gilson (Sturtevant Engineering Co. Ltd.). Nuclear Power 2, 315-16(1957) Aug.

11043

NEW DOUNREAY LABORATORIES EXEMPLIFY CURRENT BRITISH PRACTICE. Nuclear Power 2, 317(1957) Aug.

11044

BASIC HEALTH PHYSICS. 3. D. E. Barnes (AWRE, Aldermaston). Nuclear Power 2, 325-8(1957) Aug.

The problems of internal radioactivity encountered by the health physicist are considered. Critical organs, half-life effects, effective energy, surface contamination, protective methods, and monitoring are discussed. (T.R.H.)

11045

EFFECT OF ISOLOGOUS BONE MARROW AND ANTIBIOTICS IN MICE AFTER SUPRALETHAL X-IRRADIATION (1000 TO 1100 r). L. J. Cole, J. G. Habermeyer, and P. C. Nowell (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Radiation Research 7, 139-49(1957) Aug.

The protective efficacy of injected isologous bone marrow and of antibiotic was investigated at whole-body radiation doses (1000 to 1100 r) at which acute intestinal injury becomes a dominant limiting factor in survival. Under these conditions 1 mg of marrow administered intravenously afforded protection against death in two-thirds of the mice which survived the first 8-day period. Daily injections of antibiotic alone exerted a favorable effect on the number of mice able to survive to 8 days, but none of this group was alive at 30 days. All irradiated mice (1000 to 1100 r) receiving bone marrow injection showed early bone marrow regeneration (histologically) between 7 and 12 days postexposure; the animals receiving antibiotic only showed no marrow regeneration during this period. In the irradiated mice (1000 to 1100 r) surviving for 90 days, after injection of bone marrow, the body weights did not return to normal values, despite the evidence for essentially complete marrow regeneration; by contrast, in similarly treated mice after exposure to an LD_{100} dose of 800 r, the body weights recovered to normal or even higher levels. The data suggest a possible potentiation of the protective action of marrow by concomitant antibiotic administration. Under the conditions of these experiments and the radiation dose employed (1000 to 1100 r), it appears that infection is an important contributory factor to radiation deaths during the first week after radiation exposure. (auth)

11046

EVIDENCE OF SOME CHEMICAL PROTECTION OF THE MOUSE OVARY AGAINST X-IRRADIATION STERILIZATION. Roberts Rugh and Joan Wolff (Columbia Univ., New York). Radiation Research 7, 184-9(1957) Aug.

One hundred and fifty sexually mature but virgin female CF^1 mice were exposed to 50-r whole-body x irradiation and tested for reproductive capacities during 42 weeks. Some were injected intraperitoneally with a physiological salt solution (controls) and others with either cysteamine or cystamine (made in the same salt solution) prior to x irradiation to determine whether these drugs might afford any protection against x irradiation sterilization. A single whole-body exposure of the female mouse to 50 r caused all to be sterile by 30 weeks, whereas the unirradiated controls continued to reproduce for 5 months. Both cysteamine and cystamine had effects on the ovary in the nature of protection (i.e., delayed sterilization) against x irradiation sterilization. This was indicated by the increase in total number of litters expected, in the number of litters produced per week, and in extension of the reproductive life of females so treated by as much as 2.8 times over the uninjected and x irradiated controls. There was no effect of this level of x irradiation on litter size, and the final litters produced were quite normal in number. There was no evidence of partial sterilization of the female mouse, the x irradiation effect being "all-or-none" on fertility. Therefore, both cysteamine and cystamine protected the ovary of the mouse in the sense of delaying the onset of sterility. There is no presumption of any protection by these drugs against either developmental or genetic effects, only against the onset of sterility. (auth)

TOXICOLOGY STUDIES

11047 AEC-tr-2958

THE INFLUENCE OF BORIC ACID ON PLANTS, AND ESPECIALLY ON GERMINATING POLLENS. Theodor Schumucker. Translated from Planta 23, 264-83(1934-6) 20p.

Boric acid in concentrations of 0.001 to 0.01% facilitates germination not only in water-lily pollens, but to a greater or lesser extent in pollen of most widely divergent varieties. Among 40 types studied, 10 showed sensitivity to H_3BO_3. No correspondence with taxonomic position was found. The facilitation consists either in elevation of the germination percentage or in the acceleration of pollen tube growth. Usually both occur coincidentally. In pollen of the tropical water-lilies, which was found especially suitable, it was shown that the H_3BO_3 function, which is indispensable in this case, does not assert itself in the period before germination begins, but is continually essential to tube growth. Deprivation of H_3BO_3 occasions bursting or retardation of growth, and often its complete cessation. Boric acid in these cases may be termed an "inorganic crescitive." It is hypothesized that H_3BO_3 takes a direct part in the formation of membranes by virtue of its ability to combine with hydroxylated organic factors such as sugar to form compounds of stronger acidity. The hypothesis that H_3BO_3 deficiency is the root cause of the low effectiveness of artificial nutrient solutions in cases such as that of the algae was neither confirmed nor contradicted. Fungi were affected to widely varied degrees by H_3BO_3 concentrations. Penicillium tolerated over 1%; development of Phycomyces was arrested at 0.05%. Higher plants (beans) performed well in 0.002% H_3BO_3 water cultures for considerable periods, while 0.01% is quite detrimental. (auth)

TRACER APPLICATIONS

11048 AERE-Lib/Trans-749

THE INTRODUCTION OF RADIOACTIVE ISOTOPES OF STRONTIUM, CAESIUM, RUTHENIUM, ZIRCONIUM AND CERIUM INTO PLANTS. I. V. Gulyakin and E. V. Yudintseva. Translated by T. Turton from Doklady Akad. Nauk S.S.S.R. 111, 206-8(1956). 5p.

11049

STRONTIUM METABOLISM AND STRONTIUM-CALCIUM DISCRIMINATION IN MAN. C. L. Comar, R. H. Wasserman, Sven Ullberg, and G. A. Andrews (Oak Ridge Inst. of Nuclear Studies, Tenn.). Proc. Soc. Exptl. Biol. Med. 96, 386-91(1957).

CHEMISTRY

11050 AECU-3519

Los Alamos Scientific Lab., N. Mex.

THE PARTITION OF OXYGEN BETWEEN SODIUM AND TANTALUM. Charles E. Holley, Jr. July 2, 1957. 8p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS)

11051 CEA-589

France. Commissariat a l' Énergie Atomique, Paris.

ANALYSE DES MELANGES D'ORTHO ET PARA-HYDROGENES ET CONVERSION CATALYTIQUE $o\text{-}H_2 \rightleftharpoons p.H_2$. (The Analysis of Mixtures of Ortho and Para-

Hydrogen and the Catalytic Conversion $o.H_2 \rightleftharpoons p.H_2$.)
F. Botter and G. Dirian. Nov. 1956. 26p.

This report describes experiments undertaken to measure the catalytic activity at −195°C of different types of absorbents for the heterogeneous conversion $o.H_2 \rightleftharpoons p.H_2$. The analytical method employed is a differential measurement of the thermal conductivity of the gas. The experiment was conducted at room temperature (the difference of several per cent between the thermal conductivities of ortho- and para-hydrogen at this temperature being found sufficiently great) and with a continuously recording system. The gas is at atmospheric pressure. The possibilities of an industrial katharometer which would allow a great extension to be given to this method of analysis were investigated. The instrument proved satisfactory. It has been checked that the paramagnetic conversion obeys first order kinetics. A certain number of absorbing substances were tested and among them the active carbons, often used in the laboratory for the production of para-hydrogen, were shown to be the least active. A chromium oxide–aluminum oxide catalyst prepared from data available in the literature had a very great activity. In addition, some observations of the influence of adsorbed gases on the catalytic activity are reported: the comparison with the literature data is not easy due to the uncertainty in the physico-chemical nature of the absorbents used in the two cases. Finally, some bibliographic data relative to the properties of the two forms of hydrogen, their measurement, and the different mechanisms of interconversion are given. (auth)

11052 CF-54-7-59
Oak Ridge National Lab., Tenn.
DISSOLUTION OF METALS IN FUSED FLUORIDE BATHS. R. E. Leuze and C. E. Shilling. July 8, 1954. Decl. Mar. 8, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A method is presented for processing enriched reactor fuel elements. The method calls for contacting the metal with HF in the presence of a molten fluoride bath so that the metal fluoride is dissolved. This exposes fresh metal surface for further reaction. A summary of the results obtained for various metals and various dissolving conditions is given. (W.L.H.)

11053 CF-56-11-143
Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION; UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT [FOR] NOVEMBER 1956. W. K. Eister, J. C. Bresee, J. T. Long, E. O. Nurmi, and C. D. Watson. 111p. Contract [W-7405-eng-26]. $18.30(ph OTS); $6.00(mf OTS).

Chemical Engineering Research. Experiments with the three-stage pump hydroclone solvent extraction contactor show the stage efficiency with acetic acid-water-hexone to be nearly 100%. Excer. Uranium tetrafluoride with a tap density of 1.9 gm/cc can be briquetted to 3.6 gm/cc at 9 tsi. Fluorox. Three UF_4 oxidation runs in the fluidized bed reactor are described and discussed. Data are also given for three runs in a pellet-fed moving bed reactor. HR Fuel and Blanket Processing. Loop experiments with plating out of ZrO_2 from $Zr(SO_4)_2$–UO_2SO_4 solutions and flange testing are described. Other work in hydroclone development, pressurizer tests, blanket processing loops, and electrolytic production of H_2 and O_2 is reported. Power Reactor Fuel Reprocessing. Zircex reaction rates have been obtained and emissivities for Zircaloy-2 and U–Zr alloys up to 60 wt. % U have been calculated. Studies of decladding and disassembly of power reactor fuels continued. Other studies reported are corrosion studies of Ti and nickel alloys, pulse column interfacial crud removal, and waste studies. (For preceding period see CF-56-10-83.) (T.R.H.)

11054 CF-57-7-32
Oak Ridge National Lab., Tenn.
PRELIMINARY AQUA-REGIA DISSOLUTION STUDIES. K. J. Fritz. July 10, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Batch and continuous aqua-regia dissolution of 304 and 304-L stainless steels and APPR plate were studied. Dissolution techniques are described and preliminary results are presented. A short survey of the known chemistry of aqua-regia is also presented. (auth)

11055 ISC-836
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN ENGINEERING FOR JULY–DECEMBER 1956. Mar. 15, 1957. 24p. Contract W-7405-eng-82. $0.25(OTS).

11056 K-1314
Oak Ridge Gaseous Diffusion Plant, Tenn.
PREPARATION OF THORIUM OXALATE AND THORIUM AMMONIUM OXALATE POWDERS OF UNIFORM PARTICLE SIZE. A. T. Grefig. Aug. 12, 1957. 20p. Contract W-7405-eng-26. $0.20(OTS).

Attempts to prepare thorium oxalate and thorium ammonium oxalate of controlled particle size suitable for calcination to produce an oxide for use in a reactor blanket are described. The samples were prepared by rapid mixing of aqueous solutions of thorium nitrate and ammonium oxalate. Thorium ammonium oxalate was not satisfactory for the purpose intended owing to excessive sintering on calcination, while thorium oxalate could not be prepared as a uniform powder in the desired particle size range. Suggestions are presented for future work. (auth)

11057 NP-6331
Iowa State Coll., Ames.
ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Quarterly Progress Report for February 15, 1957 to May 15, 1957. Henry Gilman. [1957]. 42p. Contract AF33(616)-3510.

A novel reaction which will make available the synthesis of unsymmetrical compounds is reported. The illustrations are concerned currently with organosilicon compounds, but the range of applicability is broader. First, it has been shown that R_3SiH compounds do not react with RMgX compounds in diethyl ether to give $R_3R'Si$ compounds. Second, it has been shown that R_2SiH compounds will react to give $R_2R'Si$ compounds when the solvent is tetrahydrofuran. Third, an R_2SiH_2 compound, like $(C_6H_5)_2SiH_2$, will react with R'MgX, in diethyl ether, to give $R_2R'SiH$. A similar reaction also takes place in tetrahydrofuran. Obviously, from such $R_2R'SiH$ compounds one can proceed smoothly to the formation of $R_2R'R''Si$ compounds by the use of R''Li types. Accordingly, there are now available procedures for the convenient synthesis of tetrasubstituted silanes in which there are two, and in which there are three, unlike R groups. Fourth, experiments are now in progress with an $RSiH_3$ type which may lead by preferential reaction, involving variations of RM compound and variations of solvent, to an R_4Si type, in which all of the R groups are different. As a consequence, there is promise of a tool here for the preparation of R_4Si and other types having all possible degrees of unsymmetry. Incidental to making available for synthetic purposes, R_3SiM types where some or all of the R groups are alkyl, experiments are described for the cleavage of some appropriately substituted R_6Si_2 types by lithium in tetrahydrofuran, and particularly their reactions with chlo-

rosilanes. Experiments are described on the preparation and correlation of properties of some related types. These contain the benzyl group, the gamma-phenylpropyl group, and the p-tolyl group. Directions are provided for the synthesis of some R_3SiH compounds and for the corresponding R_3SiCl compounds prepared from them. Both of these types have been used for the synthesis of new organosilicon compounds for screening purposes. (auth)

11058 NP-6366

University of Southern Calif., Los Angeles.

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This summary deals with the chemistry of boron hydride derivatives wherein boron is bonded to elements in the fifth and sixth main groups of the periodic system. The material is divided into sections on aminoboron hydrides, phosphorus–boron chemistry, boron compounds of As and Sb, boron chemistry involving oxygen or sulfur, and miscellaneous chemistry of boron–carbon compounds. (T.R.H.)

11059 NYO-8021

Tufts Univ., Medford, Mass.

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11060 RDB(C)/TN-33

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

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11061 AEC-tr-2942

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The fundamental values of surface energy and adhesion energy are used to deduce the most important critical phase energies of simple multiphase systems consisting of pure phases. Their valency ranges and the most important thermodynamic and empirical relations existing between these values are discussed. (L.T.W.)

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11064 AEC-tr-2953

MANNITO–GERMANIC,–ZIRCONIC, AND FERRIC ACIDS. Arakel Tchakirian. Translated from Bull. soc. chim. France 10, 98-102(1943). 8p.

A comparative study was made of complex compounds obtained by adding mannitol to boric and germanic acids and zirconic and ferric hydroxides. Similarities and differences were studied by acidimetry, iodimetry, pH measurements, and measurement of optical rotation. (auth)

11065 AEC-tr-2970

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The equilibrium in the reaction $\frac{1}{2}\ GeO_2\ (s) + H_2\ (g) = \frac{1}{2}\ Ge(s) + H_2O(g)$ was measured by the flow method. The equilibrium constant and standard free energy change for 410 to 500°C were found to be $\log k_p = 2,734/T + 2.28$ and $F° = 12,508 - 10.43T$. The heat of formation of GeO_2 is −141.8 kcal/mole at 298°K. (T.R.H.)

11066 AEC-tr-2981

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11067 AEC-tr-2982

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11068 AECU-tr-2984

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It is concluded that in melts of Bi + $BiCl_3$ no definite subchloride compound is found but instead a series of mixed crystals (α) forms over a range of concentrations. These undergo transformation into a form (β), transforming with marked heat evolution. The melting point of these β crystals is always higher than the melting points of Bi and $BiCl_3$. From the β crystals after complete melting one obtains again on cooling, α crystals of different composition in the presence of two liquid layers which reproduce the same phenomena. (auth)

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A study is made of possible correlations between ionization potential differences and variable valence (number and stability of valence states) in the transition elements. Correlations are as a rule quite distinct and use may be made of ionization potential differences to provide a plausible account for a variety of differences in valence behavior; for example, differences between Ti and Zr, Hf and Th; between Fe + Co and Ru; and between Mn and Re. (auth)

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The electrical conductivity of solutions of BrF_3 and Br_2, and BrF_3 and BrF_5 have been measured. Poly-(chlorotrifluoroethylene) cells with bright platinum electrodes and Teflon insulators were employed. At 25°, bromine added to pure bromine trifluoride reduces the specific conductivity from 8.02×10^{-3} ohm^{-1} cm.$^{-1}$ to a minimum of 7.22×10^{-3} at 3.5 mole % and then increases it to 12.90×10^{-3} at 17.7 mole %, which represents the limit of the miscible region. Banks, Emeléus and Woolf first showed that at higher temperatures, the conductivity of bromine trifluoride is lowered, indicating lower stability for ionic species. This effect is accentuated by increased bromine concentration. The visible absorption spectra of dilute solutions of Br_2 in BrF_3 show deviations from Beer's law in the region close to the absorption maximum (400–500 mμ). In bromine the molar conductivity of bromine trifluoride at 25° increases steadily from the lowest to the highest concentration at which conductivity was measured 2.55 to 6.42 mole %. The rate of increase of conductivity with concentration increases sharply at about 4.3 mole %. These data are interpreted in terms of the changing dielectric constant of the medium, a mobile equilibrium involving bromine monofluoride in the Br_2–BrF_3 system, and the nature of the ionic species present. On the other hand BrF_3 and BrF_5 are completely miscible and the conductivity versus concentration plot gives a smooth curve. Mixtures of HF and BrF_5 in general are more conducting than either pure reagent with the maximum conductivity near 70 mole % HF. (auth)

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11075
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11076
THE ACTION OF ATOMIC HYDROGEN ON AQUEOUS SOLUTIONS. I. EFFECT ON SILVER, CYSTEINE, AND GLUTATHIONE SOLUTIONS. F. E. Littman, E. M. Carr, and A. P. Brady (Stanford Research Inst., Menlo Park, Calif.). Radiation Research 7, 107-19(1957) Aug.

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AEROSOLS

11077 USNRDL-TR-145
Naval Radiological Defense Lab., San Francisco.
AN ELECTROSTATIC FOG PRECIPITATOR. Evan C. Evans, III. Apr. 15, 1957. 34p. Project NS 088-001.

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11077 USNRDL-TR-145

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ANALYTICAL PROCEDURES

11078 CCC-1024-TR-243
Northwestern Univ., Evanston, Ill.
A STUDY OF NEUTRON ABSORPTIOMETRY AND ITS APPLICATION TO THE DETERMINATION OF BORON. D. D. DeFord and R. S. Braman. May 17, 1957. 88p. For Callery Chemical Co. Contract NOa(s)-1024-c.

A systematic study of both the practical and theoretical aspects of neutron absorptiometry has been made, and it has been shown that this method possesses many advantages for the determination of elements, such as B, which have high neutron absorption cross sections. The optimum geometrical arrangement of neutron source, neutron moderator, sample, and neutron detector has been worked out, and it has been found that precise determinations of boron can be carried out in a few minutes with relatively small, safe, and inexpensive neutron sources. The method is nondestructive, the state of chemical combination is immaterial, and there are few interferences. The most serious disadvantages of the method are its low sensitivity and the requirement for relatively large samples if highest precision is to be realized. (auth)

11079 CCC-1024-TR-252
Pittsburgh. Univ.
DETERMINATION OF BORON BY IONOPHORESIS. W. H. Hill, J. M. Merrill, and B. J. Palm—M. G. Haddaway, ed. June 14, 1957. 9p. For Callery Chemical Co. Contract [NOa(s) 52-1024-c].

A new method for the determination of trace quantities of boron in biological and other materials is presented. The method is based on the migration of the borate ion to the anode of an electric field and its visualization as the red boron-turmeric complex, which is developed on the paper strip after ionophoresis. The method is rapid, simple, and sensitive; as little as 0.01 μg of boron is detectable visually. (auth)

11080 CCC-1024-TR-256
Richmond, Va. Univ.
TURMERIC PAPER TEST FOR BORON. W. A. Powell, E. H. Poindexter, and J. E. Hardcastle—M. G. Haddaway, ed. July 5, 1957. For Callery Chemical Co. Project ZIP. Contract NOa(s) 52-1024-c.

A study of the existing turmeric paper test and the effect of various modifications is presented. An apparatus is developed which could be used for the detection and continuous monitoring of B in the atmosphere. A procedure for the study of variables is presented, and the effect of variables on the turmeric paper test is determined. A test is developed which is sufficiently sensitive to be used in determining the presence of small amounts of B, and sufficiently accurate to make it possible to differentiate between the presence of 0.00 and 0.01 or 0.01 and 0.02 μg of B. (auth)

11081 CF-57-6-89
Oak Ridge National Lab., Tenn.
DETERMINATION OF TRACE AMOUNTS OF SULFUR IN FLUORIDE SALTS. T. W. Gilbert and J. C. White. June 24, 1957. 11p. [Contract W-7405-eng-26]. $3.30 (ph OTS); $2.40 (mf OTS).

A method has been developed for the determination of total sulfur in fluoride salts using the methylene blue procedure. Reduction of sulfate to H_2S is achieved through the use of a new reducing mixture consisting of $SnCl_2$ dissolved in concentrated H_3PO_4. The new mixture is effective on microgram amounts of sulfate and offers a major advantage over the red phosphorous reducing mixtures in that larger samples may be taken for analysis. The procedure has been applied to fluoride salts containing from 1 to 500 ppm of S. The coefficient of variation of the method is 10%. (auth)

11082 HW-38987
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIOCHEMICAL ANALYSIS OF BRAVO SHOT SOIL SAMPLES. C. W. Thomas. Jan. 15, 1957. 18p. Contract W-31-109-Eng-52. $0.20 (OTS).

The chemical treatment and analytical procedures used for the radiochemical analysis of contaminated soil samples from a Pacific island and edible plants grown in the soil are discussed in detail. The unusual composition of the soil necessitated many revisions to circumvent interference ions. The elapsed time from detonation to analysis precluded the presence of the shorter half-lived isotopes. The radionuclide composition of the soil and isotopes translocated to the plants are presented in tabular form as supplementary information. (auth)

11083 HW-48736
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
AN EXTRACTION METHOD FOR THE DETERMINATION OF RADIORUTHENIUM IN ORGANIC SAMPLES. D. W. Shannon. May 27, 1957. 16p. Contract W-31-109-Eng-52. $0.20 (OTS).

An extraction method for determining radioruthenium in organic samples has been developed. The organic sample is added to 3 ml of a standardized organic carrier, prepared by extracting an aqueous solution of RuNO Nitrato complex with TBP and diluting with Shell Spray Base. Upon stirring, exchange takes place among the active ruthenium of the sample and the chemical Ru of the carrier. The RuNO Nitrato complex is then quantitatively extracted from the organic phase with one per cent NaOH solution. The sodium hydroxide is neutralized with acetic acid and a standardized aqueous carrier added. The Ru is then oxidized with periodic acid and distilled as ruthenium tetroxide (RuO_4). The RuO_4 is caught in 6N HCl, the Ru reduced with magnesium metal, and the resulting ruthenium metal weighed to give the chemical yield. The Ru metal is mounted and the beta activity counted. The method is rapid and simple, and reproducible results as low as 35 beta c/m/ml have been obtained. (auth)

11084 HW-49668
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DETERMINATION OF RADIOCESIUM BY COMPLEX COBALTCYANIDE PRECIPITATION. J. C. Langford. Apr. 15, 1957. 33p. Contract W-31-109-Eng-52. $0.30 (OTS).

Several quantitative precipitants for radiocesium were investigated to determine their effectiveness in separating radiocesium from other common radiocontaminants in fission product waste solutions. A satisfactory radiocesium procedure was developed which gave a decontamination factor greater than 10^5 for the γ-emitting contaminants $Zr-Nb^{95}$, Ru^{106}, Ce^{144}, and Sb^{125}. The radiocesium is carried on a cobaltcyanide precipitate formed in $\sim 3NH_2SO_4$ solution. (W.L.H.)

11085 IDO-14411
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
DETERMINATION OF URANIUM IN IRRADIATED THORIUM. Bernice E. Paige, Paul Goris, and James E. Rein. June 19, 1957. 11p. Contract AT(10-1)-205. $0.15 (OTS).

A method is given for the dissolution, separation, and

determination of U in neutron-irradiated Th. The Al jacket, if present, is dissolved in 6M nitric acid with 0.005M mercuric nitrate catalyst. After removal of the Al solution, the Th is dissolved in a mixture of concentrated nitric acid and 0.04M hydrofluoric acid. To representative aliquots, a known amount of natural U is added as an internal standard, and the U is separated from the bulk of the Th by hexone extraction. The total U^{233} concentration is determined by the mass isotope dilution method. Uranium isotopic distribution can best be determined on an aliquot to which no natural U has been added. Data are given for typical analyses. (auth)

11086 NP-6380

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE DIRECT DETERMINATION OF OXYGEN AND NITROGEN IN TITANIUM AND TITANIUM ALLOYS USING BROMINE TRIFLUORIDE. Final Report [for] Period June 28, 1956 to December 28, 1956. Hugh J. O'Neill. Jan. 23, 1957. 16p. Ord. Project TB4-15. Contract DA-11-022-505-ORD-2189.

Results of the investigation show that BrF_3 can be effectively used for the determination of O_2 and N in Ti and Ti alloys. The nitrogen values found by the BrF_3 method were in good agreement with N values determined by the Kjeldahl method. However, the presence of Al and Fe in Ti alloys tends to decrease the recovery of nitrogen. (R.V.J.)

11087 USNRDL-TR-149

Naval Radiological Defense Lab., San Francisco.

STUDIES ON CALCIUM PHOSPHATE COLUMN CHROMATOGRAPHY OF POLYNUCLEOTIDES. R. K. Main and L. J. Cole. Apr. 25, 1957. 25p. Project NM 006-015.

11088 WADC-TR-54-464(Pt. 4)

Denver. Univ. Denver Research Inst.

DEVELOPMENT OF SCHEMATIC ANALYTICAL PROCEDURES FOR SYNTHETIC LUBRICANTS AND THEIR ADDITIVES. PART IV. LABORATORY MANUAL FOR THE ANALYSIS OF SYNTHETIC LUBRICANTS, GREASES, AND THEIR ADDITIVES. Francis S. Bonomo. Oct. 31, 1956. 297p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANTS. Contracts AF33(616)-2204 and AF33(616)-3336.

Laboratory methods and techniques for the analysis of certain synthetic lubricants, greases, and their additives are described in detail, including drawings and photographs of equipment when necessary. As stipulated by WADC, none of the methods includes optical or elaborate instrumental techniques of analysis. Most of the methods employ simple wet chemical manipulations, or such techniques as adsorption or partition paper or column chromatography. The individual methods are numbered and patterned after Federal Test Method Standard No. 791. The manual is divided into five major sections: preliminary qualitative examination of the lubricant or grease, including solubility, elemental analysis, identification of grease type, and behavior of the lubricant (or base-oil from a grease) upon adsorption on a column of silica gel; qualitative detection and quantitative determination of antioxidants; qualitative detection and quantitative determination of corrosion preventive compounds; separation and quantitative determination of gelling agents and thickeners; and separation, identification, and determination of base-oils from lubricants and greases. In a number of instances parts of existing ASTM methods have been incorporated into the analytical procedures, where applicable, to avoid the use of parallel methods to the same goal. (auth)

11089 WADC-TR-56-455

Wright Air Development Center, Wright-Patterson AFB, Ohio.

STUDIES OF QUANTITATIVE METHODS FOR THE SEPARATION AND DETERMINATION OF ZIRCONIUM AND THORIUM IN MAGNESIUM ALLOYS. B. A. Raby. Aug. 20, 1956. 60p. Project 7360. (AD-130797).

The results of a comparative study of analytical methods suitable for the determination of Th and Zr in Mg base alloys are given. In addition, an attempted amalgamation of selected analytical methods and ion exchange techniques into a scheme for the quantitative analysis of Th and Zr in these alloys is described. Manganese and zinc, common constituents of Mg base alloys, were carried in the experiments, but only to study their interference in the proposed scheme. The sample is dissolved in 12N HCl and the resulting solution is percolated through a column containing Dowex 2-X8 anion exchange resin. Magnesium and thorium pass through the column while Zr, Zn, and Mn are absorbed. The latter elements are removed by eluting the column with water. The Th and Zr in the separated fractions can be determined by complexometric titration methods. (auth)

11090 AEC-tr-2952

A PROCEDURE FOR THE DETERMINATION OF MINUTE QUANTITIES OF NITRITE. H. Zimmer. Translated by E. Wait from Z. anal. Chem. 151, 258-62(1956). 5p.

A new reaction is described which makes it possible to determine NO_2^- in the range 0.02 mg to 0.06 mg NO_2^-/l with high precision. Diazotization of p-nitraniline by the NO_2^- is followed by coupling with α-naphthylamine to yield a red azo-dye whose color is directly proportional to the NO_2^-. (T.R.H.)

11091 AERE-Lib/Trans-735

DETERMINATION OF OXYGEN IN STEEL BY A SPECTROGRAPHIC METHOD. O. B. Fal'kova. Translated by J. M. Crabtree from Zavodskaya Lab. 21, 1083-7(1955). 8p.

A spectrographic method is presented for the determination of O_2 in steel. (W.L.H.)

11092

MEASUREMENT OF MILLI-MICROGRAM QUANTITIES OF THORIUM. E. Picciotto and S. Wilgain. Anal. Chim. Acta 16, 530-40(1957) June. (In French)

Thorium in solution is measured by the tracks of α-particles, formed from Th^{228}, in nuclear photographic emulsions. Using the method described, it is possible to detect Th^{228} in equilibrium with 10^{-9} g Th, contained in a volume of several hundredths of a milliliter, in the presence of all the other stable or radioactive nuclides. The accuracy is chiefly limited by the statistical fluctuations of the number of disintegrations; the experimental errors are in the order of ±3%. The method has been checked on standard solutions. The experimental techniques, diffusion of thoron, and interference of Th^{227}, are discussed in detail. (auth)

11093

THE ABSORPTIOMETRIC DETERMINATION OF URANIUM IN SOLUTIONS BY AN IMPROVED THIOCYANATE METHOD. H. T. Tucker (Hartebeestfontein Gold Mining Co. Ltd., Stilfontein, Transvaal). Analyst 82, 529-30(1957) July.

A rapid and reliable method for the absorptiometric determination of U in solutions using ammonium thiocyanate can be used in the presence of large concentrations of ferric iron. Various difficulties connected with the use of $SnCl_2$ for the reduction of ferric iron have been overcome by the use of ascorbic acid. (auth)

11094

DETERMINATION OF GOLD IN SEA WATER BY RADIOACTIVATION ANALYSIS. R. W. Hummel (Atomic Energy

Research Establishment, Harwell, nr. Didcot, Berks). Analyst 82, 483-8(1957) July.

Small portions of sea water were irradiated with slow neutrons in a Harwell Pile and the radioactivity from the Au^{198} produced was compared with that from a standard gold solution. The gold contents found depended on the distance from the shore that the samples were taken and varied from about 400 μg per cubic meter for English coastal water to about 15 μg per cubic meter for water from the north-western limit of the Bay of Biscay. (auth)

11095

THE ANALYSIS OF BISMUTH–URANIUM ALLOYS. R. A. J. Shelton (Univ. of Manchester). Analyst 82, 531-2 (1957) July.

The recovery of U and Bi from solutions containing uranyl and Bi ions is confirmed, and results are tabulated. (auth)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

11096

THE ATOMIC WEIGHTS OF FLUORINE AND SILVER. Arthur F. Scott and William R. Ware (Reed Coll., Portland, Ore.). J. Am. Chem. Soc. 79, 4253-7(1957) Aug. 20.

This is the first chemical determination of the atomic weight of fluorine by the Harvard method. Perfluorobutyryl chloride was prepared by the reaction between PCl_5 and carefully fractionated perfluorobutyric acid. The chloride was purified by fractional distillation in vacuum systems. Samples of the chloride were hydrolyzed in pyridine solution, and the chloride was precipitated with a known amount of silver. The end-point was determined nephelometrically, the final adjustment being made after the precipitate had stood for two years. The atomic weight of fluorine is calculated to be 18.999 as the average result of six analyses. This new value is shown to be in excellent agreement with the best atomic weight values derivable from mass-spectrographic measurements and from nuclear reaction data. The question of unifying the chemical and physical atomic weight scales by assigning the value 19 to the mass of the anisotopic element F is discussed. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

11097 AEC-tr-2976

METHODS AND TECHNIQUES OF PHYSICOCHEMICAL INVESTIGATIONS. A METHOD OF STUDYING THE REACTION OF ISOTOPIC EXCHANGE OF HYDROGEN IN LIQUID DEUTERIUM BROMIDE. V. R. Kalinachenko, Ya. M. Varshavskii (Varshavsky), and A. I. Shatenshtein. Translated from Zhur. Fiz. Khim. 30, 1140-3(1956). 7p.

An abstract of this appears in Nuclear Science Abstracts as NSA 11-138.

11098

HYPERFINE STRUCTURE IN THE MICROWAVE SPECTRUM OF WATER. I. QUADRUPOLE COUPLING IN DEUTERATED WATER. D. W. Posener (C.S.I.R.O., Chippendale, N. S. W.). Australian J. Phys. 10, 276-85 (1957) June.

Measurement of hyperfine structure in the microwave spectrum of D_2O gives $(eqQ)_{OD} = +\ 353 \pm 4$ kc/s for the quadrupole coupling constant of the deuteron in the direction of the OD bond, and the corresponding electric field gradient is $q_{OD} = \langle \partial^2 V/\partial \xi^2 \rangle = (1.78 \pm 0.02) \times 10^{15}$ esu. The observed hyperfine splitting of HDO is not accounted for by a simple quadrupole interaction and appears to require relatively large magnetic interaction terms for a complete description. (auth)

11099

ISOTOPIC EFFECT OF CONSTRICTIONS AND ASSOCIATIONS OF DEUTEROALCHOHOLS. I. B. Rabinovich, V. G. Golov, et al (Lobachevskiĭ Gor'kiĭ State Univ., Dept. of Chemistry). Doklady Akad. Nauk S.S.S.R. 114, 590-3(1957) May 21. (In Russian)

Studies were made of supersonic velocities and densities in the range of 10 to 60 and 80° for the alcohols CH_3OH and CH_3OD, C_2H_5OH and C_2H_5OD, $(CH_3)_2CHOH$ and $(CH_3)_2CHOD$, $CH_3(CH_2)_3OH$ and $CH_3(CH_2)_3OD$, $(CH_3)_2CHCH_2OH$ and $(CH_3)_2CHCH_2OD$, $C_2H_5CHOHCH_3$ and $C_2H_5CHODCH_3$, and also D_2O (up to 95°). The adiabatic constriction was calculated according the formula $\beta_{ad} = 1/a^2d$. The osmotic coefficients of alcohols in benzene solutions were cryoscopically measured in the interval of 0.2 to 1.7 mol/kg of the solvent. (R.V.J.)

FLUORINE AND FLUORINE COMPOUNDS

11100

PHASE EQUILIBRIA OF THE SYSTEM CHLORINE TRIFLUORIDE–HYDROGEN FLUORIDE. R. M. McGill, W. S. Wendolkowski, and E. J. Barber (Oak Ridge Gaseous Diffusion Plant, Tenn.). J. Phys. Chem. 61, 1101-5(1957) Aug.

The solid–liquid and liquid–vapor phase equilibria of the system chlorine trifluoride–hydrogen fluoride have been investigated over the composition range of 0 to 100 formula % ClF_3. The solid–liquid phase diagram is simple with a single eutectic occurring at −88.8° and 7.5 formula % ClF_3. The phenomenon of enantiotropy in chlorine trifluoride was observed at −83.1°. Liquid–vapor equilibria were determined at total pressures of 1.5, 2.0, 2.5, 3.0, and 4.0 atmospheres absolute by means of a nickel Othmer-type equilibrium still. The system is azeotropic at all these pressures, the minimum boiling azeotropic mixture containing about 67 formula % ClF_3. There is no indication of the formation of a stable complex. (auth)

GRAPHITE

11101

THE EFFECT OF DISPLACED ATOMS AND IONIZING RADIATION ON THE OXIDATION OF GRAPHITE. W. L. Kosiba and G. J. Dienes (Brookhaven National Lab., Upton, N. Y.). Advances in Catalysis 9, 398-405(1957).

The graphite-oxygen reaction on irradiated and unirradiated samples has been studied over the 250 to 450° temperature range. The irradiated samples were exposed to about 4×10^{20} neutrons/cm^2 in the reactor prior to oxidation. The exposure, which produces about 2% displaced atoms at room temperature, increased the oxidation rate relative to an unirradiated sample by about a factor of 6. The oxidation rate of untreated samples in the presence of gamma-rays alone (200,000 r/hr) was hardly altered, although a significant increase was observed at the higher intensity of 610,000 r/hr (at 300°). The reaction rate of a sample previously irradiated in the reactor and oxidized in the presence of gamma-rays (200,000 r/hr) at 300° was higher by an additional factor of about 3, i.e., a factor of about 18 relative to unirradiated specimens. It is concluded that displaced atoms exert a large influence on the rate of this heterogeneous gas-solid reaction. When, in addition, ionizing radiation is present during the reaction the rate is further increased, probably because of the ionization of oxygen molecules. (auth)

LABORATORIES AND EQUIPMENT

11102 AECU-3530
Sandia Corp., Albuquerque, N. Mex.
A HIGH TEMPERATURE ELECTRIC OVEN. L. E. Heames. June 6, 1957. 9p. Contract [AT(29-1)-789]. (TM-165-57-51). $1.80(ph OTS); $1.80(mf OTS).

The construction and operating characteristics of an electric heating chamber capable of rising from ambient temperature to 600°C in approximately twenty-five minutes is presented in detail. The oven is relatively simple to construct, small in over-all size and operates from a standard 115 volt variac. (auth)

11103 ANL-5767
Argonne National Lab., Lemont, Ill.
ACCURATE WEIGHING WITH THE MICROCHEMICAL BALANCE. D. S. Flikkema. Aug. 1957. 19p. Contract W-31-109-eng-38. $0.75(OTS).

Techniques for sixth-place weighing are discussed, with supplemental sections on balance installation and maintenance. Factors influencing apparent weights and a program for balance testing are presented. (auth)

11104 USNRDL-TR-157
Naval Radiological Defense Lab., San Francisco.
GLOVE BOX AND ASSOCIATED EQUIPMENT FOR THE REMOVAL OF RADIOACTIVE FALLOUT FROM HEXCELL COLLECTORS. A. E. Greendale and M. Honma. May 1, 1957. Project NS 088-001.

A glove box and associated equipment necessary to decontaminate large tray radioactive fallout collectors are described. Volumetrically the glove box is about four times the capacity of a standard box and contains four glove ports so that two persons may work at the same time if necessary. Advantages offered by the use of this equipment are listed. The operations involved in the decontamination of the hexcell collectors have resulted in an efficient procedure. The uses of this box may be extrapolated to other hazardous and toxic chemical or biological problems. (auth)

RADIATION EFFECTS

11105 ANL-5664
Argonne National Lab., Lemont, Ill.
EFFECTS OF IRRADIATION ON POWDER COMPACTS OF URANIUM AND SOME URANIUM-BASE ALLOYS. Final Report [for] Metallurgy Program 6.1.23. J. H. Kittel and S. H. Paine. June 1957. 42p. Contract W-31-109-eng-38. $1.25(OTS).

Results are given from irradiation experiments on powder compacts prepared from U, UH_4, and the following alloys: U–1.0, 1.4, 2.0, 2.5, and 3.5 wt. % Mo; U–1.6 wt. % Nb; and U–0.42 wt. % Si. The methods by which the compacts were prepared included end-pressing, side-pressing, hot-rolling, and hot-swaging. When sujected to irradiation, the uranium compacts invariably shortened in the pressing direction, whereas the compacts prepared from uranium hydride elongated in the pressing direction. The alloy compacts elongated in the direction of pressing, rolling, or swaging. The surface smoothness of the irradiated Mo alloy compacts improved with increasing Mo content, although dimensional stability tended to decrease. The irradiated Nb alloy showed comparatively good surface smoothness and dimensional stability, but the Si alloy specimens were badly roughened and elongated. Both the unalloyed and the alloyed compacts decreased in density under irradiation, and the rate of density decrease was found to depend strongly on the irradiation temperature. (auth)

11106 CF-57-7-100
Oak Ridge National Lab., Tenn.
IRRADIATION EXPERIMENT ON ALUMINUM FUEL PLATES CONTAINING A 48 Wt. % URANIUM–3 Wt. % SILICON–49 Wt. % ALUMINUM ALLOY WITH 20% ENRICHMENT IN THE U-235 ISOTOPE. R. J. Beaver. July 17, 1957. 6p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

11107 NYO-7498
Pennsylvania State Univ., University Park.
EFFECT OF RADIATION ON DYNAMIC PROPERTIES OF HIGH POLYMERS. Progress Report [for] July 1, 1956 to June 30, 1957. J.A. Sauer. July 1, 1957. 25p. Contract AT(30-1)-1858. $4.80(ph OTS); $2.70(mf OTS).

Dynamic mechanical measurements, together with nuclear magnetic resonance studies and observations of specific volume, were carried out over a wide temperature range for a series of polyethylene specimens both unirradiated and irradiated. The irradiations were carried out in the Brookhaven Reactor, the Penn. State Research Reactor, and a Co^{60} source. A considerable amount of new information has been obtained and reported in the technical literature. Some investigations have also been made on various types of polyamides and polyolefins. Irradiation has been shown to be a useful tool for studying transitions in polymers, and studies on the relative effects of different types of irradiation are now in progress. (auth)

11108 WADC-TR-56-534(Pt. III)
Stanford Research Inst., Menlo Park, Calif.
NUCLEAR RADIATION EFFECTS ON STRUCTURAL PLASTICS AND ADHESIVES. PART III. EXPERIMENTAL RESEARCH. [Period covered] April 15, 1956 to March 15, 1957. R. Y. Mixer and D. B. Parkinson. Mar. 15, 1957. 52p. Project title: ANPP SUPPORT. Task title: RADIATION EFFECTS. Contract AF33(616)-3632.

Nuclear radiation damage mechanisms are presented for model compounds representing several typical aircraft structural adhesives and laminates. Laminates were prepared from eight resin-curing agent systems and irradiated to 10^9 and 10^{10} rep for determination of the threshold dose for damage. The threshold dose for one system was found to be less than 10^8 rep. In the case of typical amine-cured, epoxy-type adhesives, radiation appears to cleave the amine groups with volatilization of some fragments and to crosslink the polymer chain. Small amounts of chemical changes result in large changes in physical properties of the cured adhesive. Beta and gamma irradiation have produced equal effects on one vinyl-phenolic and one epoxy-type adhesive. One organic scintillator, 2,5-diphenyloxazole, appears to be partially effective in preventing irradiation damage in an epoxy-type adhesive. (auth)

11109 WADC-TR-57-255
Esso Research and Engineering Co., Linden, N. J.
NUCLEAR RADIATION RESISTANT TURBINE ENGINE LUBRICANTS. SUMMARY REPORT FOR FEBRUARY 1, 1956–FEBRUARY 1, 1957. Alfred H. Matuszak. Mar. 28, 1957. 57p. Project Title: RADIATION EFFECTS (MATERIALS); Task Title: NUCLEAR RADIATION RESISTANT MATERIALS. Contract AF33(616)-3181. (RL-3M-57).

The results of twelve months' work aimed at developing radiation-resistant turbine engine lubricants are reported. The work was divided into two phases. Phase I covered the screening of finished lubricants or formulation modifications thereof at gamma dosages up to 10^8 roentgens. The Phase II work was concerned with screening potential lubricating oil base stocks at dosages up to 10^8 roentgens. The most promising materials could then

be formulated into several radiation resistant lubricants which could be evaluated for irradiation resistance at even higher gamma dosages where desired. (auth)

11110

THE CROSS SECTION FOR THE $^{16}O(\gamma,n)^{15}O$ REACTION. B. M. Spicer (Univ. of Melbourne). Australian J. Phys. 10, 326-9(1957) June.

RARE EARTHS AND RARE-EARTH COMPOUNDS

11111 ISC-766

Ames Lab., Ames, Iowa.

SOLVENT EXTRACTION EQUILIBRIA FOR RARE EARTH NITRATE–TRIBUTYL PHOSPHATE SYSTEMS. Lester L. Knapp, Morton Smutz, and F. H. Spedding. Aug. 1956. 44p. Contract W-7405-eng-82. $0.30(OTS).

Studies were made on the effect of process variables such as rare earth concentration, acid concentration, and salting-out agents on equilibrium data of the TBP–water–rare earth nitrate system. Distribution data were obtained for individual pure rare earths and Y in systems containing no HNO_3 or salting-out agents. The extractability of the pure rare earths was shown to increase with increasing atomic number up to a maximum at Dy and then to diminish with further increases in atomic number. Ytterbium does not follow the pattern set by the other rare earths. At low concentrations Yb was found to be the least extractable of the rare earths studied but at high concentrations appeared to be the most extractable. Yttrium behaved similarly to Yb. (auth)

11112

THE PREPARATION AND PROPERTIES OF RHENIUM OXYCHLORIDE (ReO_3Cl). Clarence J. Wolf, A. F. Clifford, and W. H. Johnston (Purdue Univ., Lafayette, Ind.). J. Am. Chem. Soc. 79, 4257-8(1957) Aug. 20.

Rhenium oxychloride has been prepared in good yields by direct chlorination of rhenium trioxide. The gaseous infrared spectrum, the gas density and the vapor pressure were determined at room temperature. The general handling procedure and some properties of this compound are discussed. (auth)

11113

THE COMPLEXING OF CERIUM(III), LANTHANUM(III) AND GADOLINIUM(III) BY FLUORIDE IONS IN AQUEOUS SOLUTION. J. W. Kury, Z. Z. Hugus, Jr., and W. M. Latimer (Univ. of California, Berkeley). J. Phys. Chem. 61, 1021(1957) July.

The experimental techniques in measuring the extent of complexing of Ce(III), La(III), and Gd(III) by fluoride ions is based upon the competition between the rare earth ions and Te(III) for fluoride ions in a ferrous-ferric concentration cell. (auth)

11114

THE HEAT OF COMBUSTION OF HOLMIUM. Elmer J. Huber, Jr., Earl L. Head, and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 61, 1021-2(1957) July.

11115

TRI-n-BUTYL PHOSPHATE AS AN EXTRACTING SOLVENT FOR INORGANIC NITRATES. II. YTTRIUM AND THE LOWER LANTHANIDE NITRATES. D. Scargill, K. Alcock, J. M. Fletcher, E. Hesfor, and H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Inorg. and Nuclear Chem. 4, 304-14(1957).

Tri-n-butyl phosphate (TBP) can be used to extract and separate Y and the lower lanthanides (lanthanum-gadolinium). Extraction from HNO_3 solutions generally increases with acidity, sometimes very steeply, though there is often a region of falling partition coefficients between say 4 and 7 M HNO_3. Extraction at low acidity but high nitrate ion concentration (added, for example, as $NaNO_3$) is usually high. Extractability increases with atomic number in the lanthanide series, with Y more extractable than any lanthanide at acidities > ~5 M HNO_3, though less extractable at low acidities. The separation factors for successive lanthanides increase with acidity and reach values as high as 2. They are also high in systems of low acidity but high nitrate concentration, and in presence of TTA (thenoyltrifluoracetone) in the organic phase. Experiments at varying TBP concentrations indicate the formation of $Y(NO_3)_3 \cdot 3TBP$ and $Ce(NO_3)_3 \cdot 3TBP$. (auth)

11116

NONMONOTONIC ORDERING OF LANTHANIDES IN TRIBUTYL PHOSPHATE-NITRIC ACID EXTRACTION SYSTEMS. D. F. Peppard, W. J. Driscoll, R. J. Sironen, and S. McCarty (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 4, 326-33(1957).

The partition of tracer-level lanthanides, Y, and Am between various TBP phases and aqueous HNO_3 phases has been studied radiometrically as a function of solvent concentration, HNO_3 concentration, and Z. In undiluted TBP systems, a plot of log K vs. Z approximates two straight lines joining at Z = 64. The line for the high-Z region has a positive slope somewhat less than that of the line for the low-Z region at 18.5 M HNO_3. This difference in slope becomes intensified as the concentration of HNO_3 is lowered, the high-Z line ultimately acquiring a negative slope. The slope of the low-Z line remains positive throughout the region studied. This general half-filled shell effect is also noted for systems involving diluted TBP. It is postulated that the extracting species is $[M(TBP)_a(H_2O)_{(x-a)}](NO_3)_3$, in which a is a function of the HNO_3 concentration and of Z. In all of the systems studied, for plotting purposes Y may be assigned an "apparent Z" of 65 to 68. In the dilute HNO_3 systems, the Am plot is nearly coincident with that for praseodymium. (auth)

11117

FRACTIONAL EXTRACTION OF THE LANTHANIDES AS THEIR DI-ALKYL ORTHOPHOSPHATES. D. F. Peppard, G. W. Mason, J. L. Maier, and W. J. Driscoll (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 4, 334-43(1957).

The extraction of lanthanides(III) and yttrium(III) into a solution of di(2-ethyl hexyl) orthophosphoric acid (symbolized as HDEHP) in a carrier solvent from aqueous mineral acid phases has been investigated as a function of HDEHP concentration in the organic phase, mineral acid concentration in the aqueous phase, and Z, using the radioactive-tracer technique and employing americium as a normalizing element. The distribution ratio, K, defined for a given radioactive nuclide as its concentration in the organic phase divided by its concentration in the aqueous phase, has been found to have a direct third-power dependency upon the HDEHP concentration in the organic phase and an inverse third-power dependency upon the mineral acid concentration in the aqueous phase. In experiments involving gross concentrations of extracting cation, it has been shown that none of the anion associated with this cation in the initial aqueous phase reports in the equilibrated organic phase. On the basis of these data, the extracting species has been formulated as $M(DEHP)_3$, possibly with solvate water. Operationally, HDEHP may be considered as the high-acid analogue of thenoyl trifluoroacetone (symbolized as HTTA); and analogously the $M(DEHP)_3$ is tentatively considered to be a chelate complex. A plot of log K vs. Z is well represented

by a straight line of positive slope corresponding to an average value of r, defined as the ratio of K_{Z+1} to K_Z, of 2.5. This average r to 2.5, to be compared with the value of 1·63 as the ratio of molar aqueous solubilities of the dimethyl phosphates of adjacent lanthanides as reported by Marsh, is sufficiently large to make fractionation of lanthanides by liquid-liquid partition an attractive possibility. Successful application of such a technique to a gross sample has been demonstrated. In the plot of log K vs. Z, Y falls on the straight line if given an artificial Z approximately 67.6 as it does in Marsh's plot of log molar solubility vs. Z for the lanthanide dimethyl phosphates. (auth)

11118

INVESTIGATIONS IN NON-AQUEOUS SOLVENTS. PART II. SOLUBILITY AND CONDUCTANCES OF SOME RARE EARTH METAL AND THORIUM ACETATES IN ETHYLENEDIAMINE. T. Muniyappan and B. Anjaneyalu (Presidency Coll., Madras). Proc. Indian Acad. Sci. A45, 412-17 (1957) June.

In investigations preliminary to the study of the electrolysis of certain rare earth metal and thorium salts in anhydrous basic solvents, it was found that anhydrous acetates of La^{3+}, Ce^{3+} and Th^{4+} are moderately soluble in anhydrous ethylenediamine. The resulting solutions show the conductance behavior of weak electrolytes. Cerium^{3+} acetate solution in ethylenediamine undergoes oxidation in air to cerium^{4+}. (auth)

SEPARATION PROCEDURES

11119 AERE-C/R-518

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

THE EXTRACTION SOLVENT. PART 3. INFRA-RED DETERMINATION OF HYDROXYLIC IMPURITIES. J. Gaunt and G. M. Meaburn. Aug. 1950. Decl. Apr. 2, 1957. 18p.

The investigation of the O-H fundamental vibration bands of butyl alcohol, monobutyl carbitol, and monobutyl cellosolve in carbon tetrachloride and dibutyl carbitol solution is described. The position of the absorption bands indicates a high degree of association between the O-H group and the C-O-C linkage, which renders impossible the characterization of the hydroxylic impurity in crude Butex. The effect of water on the position and intensity of the absorption bands is also discussed. A method of analysis for monobutyl carbitol and water in dibutyl carbitol solution has been worked out and applied to the analysis of crude Butex, on the assumption that monobutyl carbitol is the chief hydroxylic impurity in this material. (auth)

11120 CF-57-7-113

Oak Ridge National Lab., Tenn.

HRT-CP: RESULTS OF SOLIDS DISSOLUTION TESTS. W. L. Albrecht. July 30, 1957. 6p. [Contract W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A dissolution cycle in the chemical plant consists of refluxing with 10.8 M H_2SO_4 for 4 hours followed by refluxing for a like period with 4 M acid. In each of 3 tests in which 370-gram batches of simulated corrosion product solids were subjected to two dissolution cycles using 820% excess acid, more than 99.6% of the solid material was dissolved (based on the amount of undissolved material collected). In another test, using one dissolution cycle and 820% excess acid, 99.5% of the solids material was dissolved. In the final test in which a 530-gram batch of solids was subjected to two dissolution cycles using 540% excess acid, only 91.7% of the solid material was dissolved. The corrosion rate of a specimen of Carpenter 20 suspended in the vapor space of the dissolver during these tests was 0.01 mil per year. (auth)

11121 HW-50311

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RADIOCHEMICAL PROCEDURES FOR THE SEPARATION OF TRACER AMOUNTS OF Na^{24}, Mn^{56}, Cu^{64} AND Np^{239} FROM REACTOR EFFLUENT WATER. R. W. Perkins. June 4, 1957. 7p. Contract [W-31-109-Eng-52]. $1.80 (ph OTS); $1.80(mf OTS).

11122 JENER-49

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

ISOLATION OF CARRIER-FREE Cs^{137} FROM FISSION PRODUCTS. R. A. Wolschrijn. May 13, 1957. 25p.

A method for isolating carrier-free Cs^{137} from mixed fission product solutions by coprecipitation with ammonium alum is worked out. The radiochemical purity of the end product is found to be very satisfactory. (auth)

11123 NYO-6498

Pittsburgh. Univ.

A SYSTEMATIC STUDY OF SOLVENT EXTRACTION WITH ACETYLACETONE (thesis). Anoop Krishen. 1957. 140p. Contract AT(30-1)-860. $0.70(OTS).

Using acetylacetone as solvent and chelating agent, the extraction behavior of ten metals was studied. It was possible to interpret the results from a theoretical point of view and, in some cases, to calculate the successive formation constants of the acetylacetonates. The versatility of separations was enhanced when extractions were carried out in the presence of a competing complexing agent. The effect of EDTA, fluoride and tartrate was studied for a number of metals. Schemes for separation of U from Bi, Cu from Al, and Hf from Zr were devised and tested. Uranium was separated in the presence of EDTA and Hf with tartrate. In the case of Cu, separation from Al was achieved by the use of the continuous countercurrent distribution technique. The need for precise constants for various compounds was brought out and it was noted that when such values were available, better agreement of calculated and experimental values of extraction could be expected. Qualitatively, the following factors were found to affect the action of a masking agent: (a) stability of the complex formed, (b) ionization constant of the agent, and (c) the concentration of the agent. It was observed that the $pH_{\frac{1}{2}}$ value was raised in the presence of a masking agent, while the slope of the extraction curve was lowered. (auth)

11124 AEC-tr-2975

ION EXCHANGERS IN ANALYTICAL CHEMISTRY. Developments During The Last Year. U. Schindewolf. Translated by K. S. Bevis from Angew. Chem. 69, 226-36 (1957). 27p.

The efficiency of ion exchange processes determined by the equilibrium constants of ions which are affected by various factors such as the elutriant and complexing agent is discussed. An extensive table which correlates numerous separation methods for inorganic ions with literature references is given, and several special applications of ion exchangers are described. (tr-auth).

11125

TRI-n-BUTYL PHOSPHATE AS AN EXTRACTING SOLVENT FOR INORGANIC NITRATES. IV. THORIUM NITRATE. E. Hesford, H. A. C. McKay, and D. Scargill (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Inorg. and Nuclear Chem. 4, 321-5(1957).

Thorium nitrate is more readily extracted by tri-n-butyl phosphate (TBP) than are the rare earths, but it is less ex-

tractable than $Pu(NO_3)_4$ by a factor of about 10. It extracts as a di-solvate, $Th(NO_3)_4 \cdot 2TBP$, according to solubility measurements and to partition data at varying TBP concentrations. It extracts more readily from slightly acidified $NaNO_3$ than from HNO_3 of similar concentration, but if the pH rises above about 3 the partition coefficient falls again owing to Th hydrolysis. (auth)

11126

THE CONCENTRATION OF PROTACTINIUM BY RECYCLING THROUGH AN ANION-EXCHANGE COLUMN. M. K. Barnett (Mound Lab., Miamisburg, Ohio). J. Inorg. and Nuclear Chem. 4, 358-66(1957).

Protactinium was separated from major impurities by sorption on an anion-exchange resin from strong HCl, followed by washing with the acid and elution with a mixture of HCl and HF. The gamma activity of the isotope (Pa^{231}) provided an adequate analytical procedure. Addition of either $AlCl_3$ or H_3BO_3 to the elution effluent rendered the Pa resorbable by the resin. Re-elution of the Pa with mineral acids was slow, but the re-employment of the HCl-HF elutriant produced a marked concentration of the product. (auth)

11127

ION EXCHANGERS IN ORGANIC AND BIOCHEMISTRY. Calvin Calmon and T. R. E. Kressman, eds. New York, Interscience Publishers, Inc., 1957. 770p.

The first two parts of this volume are concerned with the fundamentals of ion exchange and the techniques and apparatus used in carrying out the exchange and separation of ions. The third part deals fully with its application to specific aspects of organic and biochemistry. (W.L.H.)

11128

UNDERWATER MECHANICAL TREATMENT FOR PLATE TYPE FUEL ELEMENTS. J. A. Marsh and D. Humphreys (A. C. Wilson and Partners). Nuclear Power 2, 331-3 (1957) Aug.

Underwater mechanical removal of Al from Dounreay Materials Testing Reactor fuel elements is described. (T.R.H.)

Refer also to abstracts 11115, 11117, 11125, and 11136.

SORPTION PHENOMENA

11129 CF-57-6-119

Oak Ridge National Lab., Tenn.

TESTING OF ADSORPTIVE CAPACITY OF CHARCOAL BEDS. HRT Test No. II-A 10 b. R. Van Winkle and R. R. Wiethaup. June 4, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Tests were made to determine the effects of wetting upon the adsorptive properties of fresh charcoal in the laboratory and the HRT charcoal beds in situ. (auth)

11130 HW-50600

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EFFECT OF CHEMICALS UPON INFILTRATION OF WATER INTO SOILS. K. C. Knoll. June 4, 1957. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The possibility of increasing the infiltration of water into soils by the addition of chemicals was investigated. Beneficial effects were obtained by adjusting the influent to a concentration of 1 ppm Separan 2610, 10 ppm Dow Corning Antifoam A, a common antifoam agent; or 0.1% by volume of Aerosol O. T., a wetting agent. The infiltration also was increased if Krilium was mixed intimately with the upper layer of soil in a column before adding water. (auth)

11131 AEC-tr-2992

THE THEORETICAL ANALYSIS OF DIFFUSION PROCESSES. V. V. Kafarov. Translated by S. Botcharsky from Zhur. Priklad. Khim. 29, 40-6(1956). 9p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-7596.

SYNTHESES

11132 BNL-3299

Brookhaven National Lab., Upton, N. Y.

USE OF RECOILING CARBON-14 AS A NEW TECHNIQUE IN LABELING ORGANIC COMPOUNDS. Alfred P. Wolf. [1957]. 22p. $4.80(ph OTS); $2.70(mf OTS).

These considerations must be borne in mind in applying the nuclear recoil technique for labeling purposes. The increasing amount of information being obtained in various laboratories on the effect of phase, structure and compound type should allow the formulation of generalization which can be used to evaluate the applicability of the method to a new compound. It seems clear that adequate purification is a needed prerequisite in any application. It is to be hoped that higher specific activities may be achieved in the near future. The nuclear recoil technique is a valuable adjunct to the techniques available today for labeling organic compounds. Present evidence indicates that it will be a valuable supplement to conventional synthetic methods and exchange methods. (auth)

11133 NP-6356

Denver. Univ. Denver Research Inst.

DEVELOPMENT OF "CHAIN TYPE" POLYPHENYL AND POLYNUCLEAR AROMATIC COMPOUNDS AS BASE MATERIALS FOR HIGH TEMPERATURE STABLE AND RADIATION RESISTANT LUBRICANTS AND HYDRAULIC FLUIDS. Quarterly Progress Report No. 7 for April 15, 1957–July 15, 1957. Josef J. E. Schmidt and John A. Krimmel. July 15, 1957. 23p. Project 7-(1-3044). Contract AF33(616)-2939.

The synthesis of a number of homologous 4'-substituted alkyl-m-terphenyl derivatives in which the alkyl side chain is a normal straight chain, or a symmetrically branched chain, or a methyl branched chain is reported. Synthesis methods for other m-terphenyl compounds from pyrilium salts are outlined and the preparation of intermediates for the 3-alkyl-m-terphenyl derivatives and the attempted synthesis of 3-heptyl-m-terphenyl are presented. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

11134

THE CRYSTAL STRUCTURE OF $PuAl_3$. Allen C. Larson, Don T. Cromer, and C. K. Stambaugh (Los Alamos Scientific Lab., N. Mex.). Acta Cryst. 10, 443-6(1957) July.

The crystal structure of $PuAl_3$ has been determined by single-crystal methods. The structure is hexagonal with $a = 6.10 \pm 0.02$, $c = 14.47 \pm 0.04$ A, $Z = 6$ units of $PuAl_3$ per unit cell, and most probable space group $P6_3/mmc$. The structure is a new type of AB_3 structure and is an example of a type of hexagonal closest packing in which the stacking sequence is ...A B C A C B A..., rather than ...A B A B... as in the usual hexagonal closest-packing structure. This structure is related to that of the cubic substance UAl_3 through an ordered rearrangement of the close-packed layers parallel to the (111) plane and a slight distortion of this 'ideal' structure caused by the relative size difference between Pu atoms and Al atoms. (auth)

11135

THE SELF-REDUCTION OF AMERICIUM(V) AND (VI) AND

THE DISPROPORTIONATION OF AMERICIUM(V) IN AQUEOUS SOLUTION. G. R. Hall and T. L. Markin (Atomic Energy Research Establishment, Harwell, Berks). J. Inorg. and Nuclear Chem. 4, 296-303(1957).

The kinetics of the self-reduction of Am(V) and Am(VI) have been studied in $HClO_4$. A mechanism is postulated which accounts for the nonappearance of Am(III) during the simultaneous self-reduction of Am(V) and Am(VI) in dilute acid solutions. Am(IV), produced by the disproportionation of Am(V) in moderately concentrated perchloric acid solutions, is reduced to Am(III) and does not react with Am(V). The decrease in the value of the rate constant for the self-reduction of Am(VI) with increasing sulfuric acid concentration, is shown to be due to the increase in the rate of disproportionation of Am(V). (auth)

11136

TRI-n-BUTYL PHOSPHATE AS AN EXTRACTING SOLVENT FOR INORGANIC NITRATES. III. THE PLUTONIUM NITRATES. G. F. Best, H. A. C. McKay, and P. R. Woodgate (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Inorg. and Nuclear Chem. 4, 315-20 (1957).

Plutonium(III) nitrate is relatively inextractable by tri-n-butyl phosphate (TBP), but plutonium^{4+} and $PuO_2(NO_3)_2$ are freely extractable. Plutonyl nitrate is, however, less extractable than $UO_2(NO_3)_2$ by a factor of about 10. Experiments in which the TBP concentration was varied indicated the formation of $Pu(NO_3)_4 \cdot 2TBP$ and $PuO_2(NO_3)_2 \cdot 2TBP$. In the case of $Pu(NO_3)_4$ it was shown that the temperature coefficient of extraction is small, that salting-out by $NaNO_3$ causes a striking increase in extraction, and that $UO_2(NO_3)_2$ depresses the extraction. Increase in the $Pu(NO_3)_4$ concentration may either raise or lower the partition coefficient according to the conditions. (auth)

11137

ISOLATION OF BERKELIUM BY SOLVENT EXTRACTION OF THE TETRAVALENT SPECIES. D. F. Peppard, S. W. Moline, and G. W. Mason (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 4, 344-8(1957).

Data for the extraction of Cm(III), Bk(III), and Bk(IV) into a n-heptane solution of di(2-ethyl hexyl) orthophosphoric acid from various aqueous nitric acid phases are presented. The K value for Bk(IV) is greater than that for Bk(III) or Cm(III) by a factor approaching 10^6. Under the oxidizing conditions used, Am remains in the trivalent state. A flow sheet utilizing this solvent extraction system and involving both the trivalent and tetravalent states of Bk has been devised. Using a raw berkelium fraction, isolated in the preliminary processing of an exhaustively neutron-irradiated plutonium sample, as feed, a Bk^{249} product was isolated in approximately 97% yield with established alpha decontamination factor and beta decontamination factor of approximately 6×10^3 and 9×10^5, respectively. The total processing time, exclusive of evaporation, was less than 30 min. In an experiment involving the same flow sheet and a synthetic feed, it was demonstrated that Bk may be separated rapidly and satisfactorily from all of the following: La, Pm, Eu, Y, U, Np, Pu, Am, and Cm. Elements of Z greater than 97 were not available for testing, but it appears certain that Bk would be satisfactorily separated from any of these present in the trivalent state. It is suggested that this, solvent-extraction procedure should be useful not only for the isolation of Bk from source materials, but also in milking experiments in which a Bk isotope is either the mother or daughter, especially in studies in which one or more of the nuclides involved is short-lived. (auth)

11138

CHLORIDE COMPLEX IONS OF Pu(VI). T. W. Newton and F. B. Baker (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 61, 934-8(1957) July.

The effect of chloride ion on the absorption spectrum of Pu(VI) has been investigated in solutions with $\mu = 2$. At eight different wave lengths the absorption was determined as a function of (Cl^-) from 0 to 1.8 M. Making the usual assumptions, it was found that the data at any one wave length were consistent with the formation of a single complex ion with a constant association quotient and constant absorptivity. However, the apparent association quotients obtained in this way were not constant, but were a function of wave length. In order to explain this behavior it was found necessary to assume that a higher complex is present, the absorptivities are dependent on (Cl^-) at some of the wave lengths, or both. Experiments at 50° indicated more complexing at higher temperatures. (auth)

11139

ISOTOPIC EXCHANGE BETWEEN Pu(III) AND Pu(IV). Thomas K. Keenan (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 61, 1117-20(1957) Aug.

The rate of exchange between Pu(III) and Pu(IV) in aqueous perchlorate media has been investigated. The exchange is rapid so that it was necessary to work in the concentration range of 10^{-6} to 10^{-5} f total plutonium. Satisfactory separation techniques were developed for this concentration region. Over the temperature range 0 to 25°, at ionic strength 2.00, the rate law may be approximated: rate (mole-liter^{-1}-min.$^{-1}$) = 1.8×10^{10} $[Pu^{+3}]$ $[Pu^{+4}]$ $\exp(-7700/RT) + 1.3 \times 10^8$ $[Pu^{+3}]$ $[Pu(OH)^{+3}]\exp(-2800/RT)$. The rate increases with increasing ionic strength. (auth)

URANIUM AND URANIUM COMPOUNDS

11140 RDB(C)/TN-60

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England. THE REACTION OF UF_4 WITH UF_6. J. S. Broadley and P. B. Longton. Mar. 1, 1954. 13p. (DDC/P-68).

As part of an investigation into the corrosion of metals by UF_6 the system $UF_4(s)-UF_6(g)$ has been studied under closely defined experimental conditions. The formation of the intermediate fluorides U_4F_{17}, U_2F_9 and βUF_5 was found to be stepwise, each stage proceeding at a well defined reaction-initiation temperature. The properties of the intermediate fluorides obtained were compared with previous findings, and were identified by x-ray-diffraction analysis. (auth)

11141 AEC-tr-2990

METHOD OF OBSERVING URANIUM UNDER THE PHOTOEMISSION ELECTRON MICROSCOPE. E. L. Huguenin and M. Gauzit. Translated by K. S. Bevis from Compt. rend. 242, 1309-11(1956). 3p.

Techniques of uranium studies under a photoemission electron microscope using electrolytically polished uranium in a bath containing ions of iron and silver are described. A technique is suggested also for observations of electron diffraction of U at elevated temperatures. (R.V.J.)

11142 AEC-tr-2994

A NEW METHOD FOR THE MICROGRAPHIC EXAMINATION OF URANIUM BY THE FORMATION OF EPITAXIAL LAYERS OF OXIDE. A. Robillard, J. Durand, and P. Lacombe. Translated by K. S. Bevis from Compt. rend. 242, 508-10(1956). 3p.

11143

THE THERMAL DECOMPOSITION OF URANIUM PEROXIDE, $UO_4 \cdot 2H_2O$. James E. Boggs and Munzier El-

Chehabi (Univ. of Texas, Austin). J. Am. Chem. Soc. 79, 4258-60(1957) Aug. 20.

$UO_4 \cdot 2H_2O$ decomposes slowly in the temperature range 90 to 195° to form a different peroxide, U_2O_7. The rate of this reaction has been followed and the properties of U_2O_7, which has not been isolated previously, have been investigated. (auth)

11144

QUINQUEVALENT COMPOUNDS OF URANIUM. II. URANIUM PENTA-n-ALKOXIDES. D. C. Bradley and A. K. Chatterjee (Birkbeck Coll., London). J. Inorg. and Nuclear Chem. 4, 279-82(1957).

The quinquevalent uranium compounds $U(OR)_5$, where R = Me, Et, Pr^n, Bu^n, and Am^n, have been prepared and their molecular weights have been determined ebullioscopically in benzene. Boiling points were determined under reduced pressure. These results are discussed from the structural viewpoint, and it is proposed that uranium penta-alkoxides may involve uranium in co-ordination numbers of 6 and 8. The uranium penta-alkoxides are compared with the corresponding derivatives of niobium and tantalum. (auth)

11145

SOME COMPLEX CHLORIDES OF URANIUM TETRACHLORIDE AND THORIUM TETRACHLORIDE. John R. Ferraro (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 4, 283-6(1957).

The preparation of the five anhydrous complex chlorides $[(CH_3)_4N]_2UCl_6$, $[(C_2H_5)_4N]_2UCl_6$, Cs_2UCl_6, $[(CH_3)_4N]_2ThCl_6$, and Cs_2ThCl_6 is described. The results of powder x-ray-diffraction studies of these compounds are given, and the possibility of hydrates existing for the thorium complexes is discussed. (auth)

11146

HYDRATION OF URANYL NITRATE IN ORGANIC SOLVENTS. H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Inorg. and Nuclear Chem. 4, 375-6(1957)

Refer also to abstract 11105.

WASTE DISPOSAL

11147 BNL-447

Brookhaven National Lab., Upton, N. Y.

DEVELOPMENT OF A WASTE CALCINER. Progress Report on WASTE PROCESSING DEVELOPMENT PROJECT. B. Manowitz and S. Zwicker. Apr. 1957. 11p. $0.15(OTS).

The work of the Waste Processing Development Project at BNL has led to the development of a piece of equipment capable of substantially reducing the volume of high activity aqueous waste streams. This equipment, known as a "continuous calciner," is a heated-tube auger-agitated concentrator which dehydrates and fuses the various aqueous salt solutions to an anhydrous free-flowing melt on a continuous basis. A pilot plant model of this equipment has been operated successfully with an attendant decontamination factor of approximately 1000. The corrosion rate of mild steel in neutralized solutions and in the fused salt product was studied. No corrosive effects were detected, which indicated that mild steel is a safe storage container material. An economic evaluation was also made to compare relative costs of processing and storing an acid waste solution in a raw, neutralized, or anhydrous state. (auth)

11148 CRHP-709

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE CHALK RIVER LIQUID DISPOSAL AREA, 1956. I. L. Ophel and C. D. Fraser. June 1957. 42p.

Five surface pits in the Chalk River Liquid Disposal Area have been used since December 1952 for the disposal of wastes containing fission products. The Liquid Disposal Area is situated on elevated ground with low-lying swampy areas to the east and south. Since November 1955 the surface water of these swamps has been contaminated by the seepage of water containing several radioisotopes. Investigations show that three of the five disposal pits are contributing to this surface contamination. The streams and a lake receiving the drainage from these swamps also show low levels of contamination. Examination of the contaminated area shows Sr^{90} to be the most important of the radioisotopes present. The amounts of Sr^{90} present in the stream draining the area are not sufficient to raise the stream water to the drinking water tolerance concentration. Present levels of Sr^{90} in the plants and animals of the area do not constitute a hazard to man, and contamination is entirely confined to the Chalk River exclusion area. (auth)

11149 HW-51841

[General Electric Co. Hanford Atomic Products Operation], Richland, Wash.

[THE PROPOSED SYSTEM FOR RADIO REMOTE CONTROL OF A BULLDOZER FOR BURIAL OF RADIOACTIVE WASTE.] (Summary letter and scope Blueprint). G. L. Davis. Feb. 19, 1957. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

ENGINEERING

11150 NACA-TN-3781

New York Univ., New York.

HANDBOOK OF STRUCTURAL STABILITY. PART I. BUCKLING OF FLAT PLATES. George Gerard and Herbert Becker. July 1957. 105p.

The various factors governing the buckling of flat plates are critically reviewed and the results are summarized in a comprehensive series of charts and tables. Numerical values are presented for buckling coefficients of flat plates with various boundary conditions and applied loadings. The effects of plasticity are incorporated in nondimensional buckling charts utilizing the three-parameter description of stress-strain curves. (auth)

11151 NACA-TN-3782

New York Univ., New York.

HANDBOOK OF STRUCTURAL STABILITY. PART II. BUCKLING OF COMPOSITE ELEMENTS. Herbert Becker. July 1957. 72p.

The local buckling of stiffener sections and the buckling of plates with sturdy stiffeners are reviewed, and the results are summarized in charts and tables. Numerical values of buckling coefficients are presented for longitudinally compressed stiffener sections of various shapes, for stiffened plates loaded in longitudinal compression and in shear, and for stiffened cylinders loaded in torsion. Although the data presented consist primarily of elastic-buckling coefficients, the effects of plasticity are discussed for a few special cases. (auth)

11152 NACA-TN-3783

New York Univ., New York.

HANDBOOK OF STRUCTURAL STABILITY. PART III. BUCKLING OF CURVED PLATES AND SHELLS. George Gerard and Herbert Becker. Aug. 1957. 159p.

Available theories and test data on buckling of curved plates and shells are reviewed. The test data for torsion

and external-pressure loadings are correlated in terms of linear buckling theories for both the elastic and inelastic ranges. The cases which exhibit a marked disagreement between linear theory and test data have been analyzed by a unified semiempirical approach which is satisfactory for analysis and design purposes. (auth)

11153 NACA-TN-3784
New York Univ., New York.
HANDBOOK OF STRUCTURAL STABILITY. PART IV. FAILURE OF PLATES AND COMPOSITE ELEMENTS. George Gerard. Aug. 1957. 97p.

Available theories on failure of flat plates are reviewed, and test data on the postbuckling behavior, effective width, and failure of flat and curved plates are correlated. Test data on the crippling strength of various formed and extruded shapes are reviewed, from which a generalized method of crippling analysis is formulated. This analysis is then applied to a variety of sections and materials in common use. (auth)

11154 NACA-TN-3785
New York Univ., New York.
HANDBOOK OF STRUCTURAL STABILITY. PART V. COMPRESSIVE STRENGTH OF FLAT STIFFENED PANELS. George Gerard. Aug. 1957. 91p.

A generalized crippling analysis for short monolithic panels with formed or extruded stiffeners is presented. Methods are presented for determining if riveted panels act in a monolithic manner and for determining the strength of those which do not. The failure modes of intermediate-length and long stiffened panels are discussed and methods given for estimating column strength. Theory and test data on optimum stiffened panels are presented and the various factors of importance in box types of construction are considered. (auth)

11155 NP-6354
Standard Oil Co. of Indiana, Whiting.
DEVELOPMENT OF THICKENERS FOR HIGH TEMPERATURE GREASES. Quarterly Progress Report No. 23 [for] January 10, 1957 to April 10, 1957. J. C. Goossens. Apr. 1957. 10p. Contract AF33(038)-23687.

Monthly Progress Report No. 71 is incorporated in this report and will not be issued separately.

Thickeners are being synthesized and evaluated for use in greases for temperatures in excess of 450°F and as high as 700°F. Until fluids suitable for use in this temperature range are available, this work is being guided by a knowledge of the general requirements for the desired thickeners. Organic compounds with melting points above 650°F which can be prepared relatively easily from available starting materials are being prepared and screened as potential thickeners. In the preliminary screening, the amount required to thicken DC 550 Silicone Fluid to an NLGI No. 1 or 2 consistency and the effect of elevated temperatures on evaporation and consistency before and after mechanical working of the grease are being determined. Those thickeners that appear promising in screening tests will then be tested in high-temperature bearing tests. (auth)

11156 NP-6357
Shell Development Co., Emeryville, Calif.
ENGINE OIL DEVELOPMENT. Quarterly Progress Report No. 6 for Period February 1 through April 30, 1957. C. L. Mahoney, K. J. Sax, W. W. Kerlin, and E. R. Barnum. 46p. Project No. 7-(1-125A). Contract AF 33(616)-3182. (S-13724).

The investigation of polyphenyl ether derivatives for use as radiation-resistant high-temperature lubricants has continued to show promise. In general, polyphenyl ethers have good radiation resistance and thermal stability though a few derivatives are deficient in this latter respect. Lubrication characteristics, as measured by high-temperature four-ball wear tests, are also good for nearly all of these compounds. For ethers as well as most other potential high temperature lubricants, upper useful temperature limits are much more often set by oxidation stability than by the other properties discussed above. Unsubstituted polyphenyl ethers are appreciably more resistant to oxidation and thermal decomposition than are derivatives containing alkyl substituents. Unsubstituted ethers that are readily prepared have rather high melting points. The most promising substituted ethers examined so far contain tert-butyl or α-cumyl groups. With these substituents, low-melting compounds can be prepared which undergo little change in oxidation-corrosion tests at temperatures approaching 500°F and form little coke at 800°F panel temperatures. Various stability and physical property relationships have been developed for polyphenyl ether derivatives. Only the structure and the molecular weight need be known to make a close prediction of the high-temperature performance limits and physical properties. (auth)

11157 NP-6363
Shell Development Co., Emeryville, Calif.
RESEARCH ON THE DETERMINATION OF THE STABILITY OF JET ENGINE FUELS. Quarterly Progress Report No. 2 [for] December 1, 1956 through February 28, 1957. Harry B. Minor, Alan C. Nixon, and Roy E. Thorpe. 45p. Contract AF33(616)-3888. (S-13721).

Examination of three jet fuels exposed to mixed gamma-neutron irradiation in the SPT No. 2 Test at Convair shows that the thermal stability of all three fuels was considerably decreased by the exposure in spite of the fact that little chemical damage occurred. These results are considerably different from those observed after exposure to 10^8 gamma from spent fuel elements in which two of the three fuels were improved in thermal stability and the third suffered only a relatively slight decrease, even though chemical attack was considerable. The investigation of the radiation stabilities of fuel components and model compounds has been continued with the object of identifying the types of compounds that lead to poor radiation stability. Several antioxidants have been found which improved the thermal stability of a moderately stable JP-4 fuel. At concentrations of 0.1% w the time to plugging at 450°F was increased by a factor of 12 in one case and the rate of deposition in the preheater and on the filter was decreased markedly. High temperature performance of the additive blends was generally decreased by oxidation at 100°C for 48 hours, although the performance of some fuels and one additive blend was improved by this exposure. The results of storage tests at 110°F indicate that the only generally useful additives for reducing the rate of gum and peroxide formation are those of a chelating type. At the present time the best choice for an ANP chemical fuel would be one composed almost exclusively of naphthenes. However, this is extremely tentative and additional information on the effect of neutron irradiation on thermal stability must be obtained. (auth)

11158 WADC-TR-57-177
Shell Development Co., Emeryville, Calif.
ENGINE OIL DEVELOPMENT. Period Covered: September 15, 1955 through November 1, 1956. C. Lynn Mahoney, William W. Kerlin, Emmett R. Barnum, and Karl J. Sax. Nov. 1956. 109p. Project title: RADIATION EFFECTS (MATERIAL). Task title: NUCLEAR RADIATION RESISTANT MATERIALS. Contract AF33(616)-3182.

Inhibited lubricants, made from ester or aliphatic-

hydrocarbon base oils, are highly sensitive to radiation damage even in absence of oxygen. The effect on the base oil itself, measured by such properties as viscosity change or formation of acidic products, is generally relatively small at radiation doses less than 10^8 reps. The antioxidant, however, acts as a radical scavenger. While protecting the base oil against radiation-induced change, it is selectively inactivated. Degradation products formed during irradiation of ester oils also greatly reduce the oxidation stability of inhibited lubricants. The strong phosphoric acid derivatives increased decomposition of the ester, leading to very high deposit levels in panel coke tests. The high panel coke deposits found with other irradiated ester lubricants were also caused by the presence of tricresyl phosphate. Auto-oxidation proceeds through free radical chain reactions. Therefore, oxidation reactions would be accelerated during irradiation. The stability of inhibited oils, in oxidation-corrosion tests conducted in a γ-ray source, decreased rapidly as the radiation dose rate was increased. No protection against antioxidant radiation damage was found through use of radical scavengers or energy transfer agents (various iodine-containing compounds or aromatic materials). Base oil damage could be reduced through use of such materials but the reactivity of antioxidants towards radicals was considerably greater than compounds added as protectors. The dialkyl selenides show some promise for use with ester or hydrocarbon base oils at temperatures and radiation levels somewhat above those attainable with the more usual antioxidants. For use at bulk oil temperatures above 400°F or at total radiation doses of 10^8 reps or higher, inherently-stable, aromatic-containing materials will probably be needed. Silyl, ether, and ester groups can be used to link aromatic nuclei without large reduction in oxidation or radiation resistance. Preliminary examination of some of these synthetic compounds shows that their useful life, determined in oxidation tests at 400°F, would be at least 10 to 20 times longer than the most stable of the MIL-L-7808C ester lubricants. Additional aromatic derivatives are being prepared and examined in various high temperature screening tests. (auth)

HEAT TRANSFER AND FLUID FLOW

11159 AECU-3523

Purdue Research Foundation, Lafayette, Ind.

FREE CONVECTION HEAT TRANSFER TO A HORIZONTAL CYLINDER FROM AN ORDINARY FLUID CONTAINING A VOLUME HEAT SOURCE (thesis). Isaac Eric Randall. Aug. 1957. 69p. Contract AT(11-1)-432. $12.30 (ph OTS); $4.50 (mf OTS).

Heat transfer by free convection to a horizontal cylinder from an ordinary fluid containing a volume heat source was studied analytically. It was found that a first approach to this problem was to assume that the heat source existed only in the boundary layer surrounding the cylinder. Solution was accomplished by solving the problem for a vertical flat plate cooling the fluid containing the heat source, and transforming the results to a horizontal cylinder. It was found that within the limits of laminar flow that a volume heat source in the boundary layer will increase the heat transfer coefficient for any given temperature difference across the boundary layer. This increase, however, is not large, being about 20% for a heat source of 100 Btu/sec-ft^3 and a temperature difference of 20°F. For a one-fourth inch O.D. cylinder with a heat source of 60 Btu/sec-ft^3 in the fluid and a temperature difference of 20°F the average heat transfer coefficient is 2.2% greater than the average heat transfer coefficient without heat source. (auth)

11160 AGC-1310-4

Aerojet General Corp., Azusa, Calif.

EXPERIMENTAL STUDIES ON HEAT TRANSFER AND FLUID FLOW SYSTEMS. Quarterly Report [For] April 1 through June 30, 1957. E. L. Geery, L. Green, Jr., and K. L. Nall. Aug. 9, 1957. 84p. Project 6-(1-0064). Contract AF33(616)-3767.

A review of heat transfer in unconsolidated porous media has suggested a new method of data correlation which shows improvement over methods previously advanced, and which will be employed for correlation of the data on heat transfer in consolidated structures obtained in the present program. (auth)

11161 EES-030038

Naval Engineering Experiment Station. Mechanical Lab., Annapolis.

CONDENSING HEAT TRANSFER RATES OF TUBES OF VARIOUS MATERIALS. R. M. Jackson, Jr. July 12, 1956. 23p. (AD-115343).

Condenser tubes of various materials were tested to determine the condensing steam-to-water heat transfer rates. Comparative tests were made for water velocities up to 25 ft/sec. Next to admiralty brass the highest heat transfer rates were obtained with the Ti and 90-10 Cu–Ni tubes. (auth)

11162 KAPL-951(Rev. I)

Knolls Atomic Power Lab., Schenectady, N. Y.

EVALUATION OF TRANSIENT TEMPERATURES AND STRESSES. R. J. Fritz. July 1, 1957. 37p. Contract W-31-109-Eng-52. $0.30 (OTS).

Solutions to the one-dimensional heat conduction equation for arbitrary surface temperature transients are treated by superposition of other solutions and by a concept of thermal reflections. The maximum thermal stresses are given for a flat plate due to a given surface temperature change at a linear rate. Thermal stresses in thin cylindrical shells are discussed, and an example is evaluated. Design factors are discussed briefly, principally by citing critical problems and giving references. A comprehensive bibliography is presented. (auth)

11163 NACA-RM-E51H23

Lewis Flight Propulsion Lab., Cleveland.

WIRE CLOTH AS POROUS MATERIAL FOR TRANSPIRATION-COOLED WALLS. E. R. G. Eckert, Martin R. Kinsler, and Reeves P. Cochran. Nov. 13, 1951. 38p.

The permeability characteristics and tensile strength of a porous material developed from stainless-steel corduroy wire cloth for use in transpiration-cooled walls where the primary stresses are in one direction were investigated. The results of this investigation are presented and compared with similar results obtained with porous sintered metal compacts. A much wider range of permeabilities is obtainable with the wire cloth than with the porous metal compacts considered and the ultimate tensile strength in the direction of the primary stresses for porous materials produced from three mesh sizes of wire cloth are from two to three times the ultimate tensile strengths of the porous metal compacts. (auth)

11164 NP-6349

Wayne Engineering Research Inst., Detroit.

INTERFEROMETRIC STUDIES OF NATURAL CONVECTION HEAT TRANSFER FROM INCLINED HEATED FLAT PLATE IN AIR. Interim Technical Report No. 3. George R. Inger. Mar. 1956. 48p. WERI Project 200-87. Contract DA-20-018-ORD-13356.

11165 UTIA-41

Toronto. Univ. Inst. of Aerophysics.

THEORY OF FREE-MOLECULE, ORIFICE-TYPE, PRESSURE PROBES IN ISENTROPIC AND NONISENTROPIC FLOWS. G. N. Patterson. Nov. 1956. 21p. Contract AF18(600)-1185. (OSR-TN-57-13; AD-115045).

The theory is presented of a pressure probe in the form of an orifice in the side of a tube which may be orientated in any direction relevant to that of the mass motion and which is so small compared with the local mean free path that free-molecule flow occurs. The theory shows that such a tube will measure the local speed ratio in isentropic and nonisentropic flows and suggests that in strong shock waves it may be possible to determine the viscosity and heat conduction, that is, the deviation from Maxwellian molecular motion. (auth)

11166 WAPD-TH-306

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

ADDITIONAL 2000 PSIA VERTICAL UPFLOW BURNOUT DATA FOR 0.053 IN. × 1 IN. × 12.06 IN. LONG RECTANGULAR CHANNELS WITH AN INLET WATER TEMPERATURE OF 500°F. R. Masnovi. 5p. $1.80(ph OTS); $1.80(mf OTS).

Burnout experiments were performed for a 0.05 in. × 1 in. × 12.06 in. long rectangular channel (L/D = 120) with an inlet water temperature of 500°F. The mass flow rate was varied from 0.18×10^6 to 2.10×10^6 lb/hr-ft^2. The results indicate that the inconsistent data for an inlet water temperature of 500°F reported in WAPD-TH-225 can be considered invalid. The data agree, in general, with the other burnout data reported in WAPD-TH-225. (L.T.W.)

11167 WAPD-TH-318

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EFFECT OF DISSOLVED HYDROGEN ON BURNOUT FOR WATER FLOWING VERTICALLY UPWARD IN ROUND TUBES @ 2000 PSIA. R. A. DeBortoli and R. Masnovi. Apr. 15, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

Tests to determine the effect of dissolved H_2 on burnout for water at 2000 psia flowing vertically upward at an inlet temperature of 500°F were conducted on a nickel tube 0.186 in. inside diameter × 0.227 in. outside diameter × 12 in. long (L/D = 64.5). The H_2 concentration was varied from 0 to 135 cc/kg. The majority of the testing was done at a mass velocity of 2.0×10^6 lb/hr-ft^2. Three additional runs were made at mass velocities of 1.0×10^6, 0.80×10^6, and 0.55×10^6 lb/hr-ft^2. Hydrogen concentration had no apparent effect on burnout. (auth)

11168 T-4(RAND)

MONOGRAPH ON THE THEORY OF CHARACTERISTICS. G. Guderley. Translated by K. G. Liebhold. Sept. 1, 1947. 226p.

A method was developed for two-dimensional steady flow and can be applied as well to nonsteady, one-dimensional, and supersonic flow. (W.L.H.)

11169

BOILER CIRCULATION RESEARCH. Nuclear Eng. 2, 324-6(1957) Aug.

The circulation of water in boiler tubes at high pressures is a complex subject and most of the theories are based on the supposition that the vapor-water mixture in a boiler tube behaves as a homogeneous fluid; a convenient theory, but one which has some objectionable features. A series of experiments has been performed with 2.54 cm diameter tubes at pressures approaching 210 kg/cm^2, and other experiments on larger, different tubes are in progress. The apparent density of the vapor-water is measured by the use of γ rays from a Cs source. (Tr-auth)

Refer also to abstract 11180.

MATERIALS TESTING

11170 HW-40512

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INITIAL OPERATING PROCEDURES FOR 105-C METAL EXAMINATION FACILITY. R. L. Reynolds. Dec. 20, 1955. 42p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30(mf OTS).

A detailed description is given of the operating procedures and equipment of the 105-C metal examination facility. (W.L.H.)

11171 NAVORD-4542

Naval Ordnance Lab., White Oak, Md.

NOL REACTOR VESSEL CONTAINMENT PROGRAM. (NOL-285, DAMAGE FROM EXPLOSION OF NUCLEAR REACTORS.) Quarterly Progress Report for the Period, January 1, 1957 to March 31, 1957. Walter R. Wise, Jr. June 28, 1957. 15p.

The purpose of the NOL Reactor Vessel Containment Program is to produce basic information which will assist in determining the optimum containment design of nuclear reactor vessels. The purpose is to be achieved through a fundamental investigation of the structural response of steel cylinders to internal loading. Progress of the work consists essentially of designing the mechanical paraphernalia for sealing and constraining the model test cylinders, designing and developing the required instrumentation, and deriving the energy equations of dynamic equilibrium. These equations constitute the fundamental analytic tool for the work. (auth)

11172 NRL-4942

Naval Research Lab., Washington, D. C.

A DIFFERENTIAL THERMAL ANALYSIS APPARATUS FOR TEMPERATURES UP TO 1575°C. Kenneth G. Skinner. Apr. 15, 1957. 14p.

The determination of mineralogical and/or physical-chemical parameters up to 1575°C is vital in the evaluation of ceramic materials, such as barium titanate. The use of a differential thermal analysis apparatus aids in determining such parameters. However, the combination of high temperatures and chemical reactivity of the materials to be tested excluded the use of the usual type d.t.a. apparatus. A d.t.a. apparatus designed and built at the Naval Research Laboratory combines the advantages of operation to 1575°C and of holders which do not react with the sample. A test sample and a standard sample (ignited alumina) are placed in separate cups, the center of the bottom projecting upward to form a thermocouple-protecting tube. Each cup is placed upon a junction of the differential thermocouple which protrudes slightly through the top of a ceramic head in the center of the heat zone. A ceramic cap fits on the head and covers the two cups to aid in maintaining even heat distribution. Grounded, heavy-gage platinum foil is wrapped on the outside of both the head and the cap to prevent pickup of electrical currents caused by rectification at higher temperatures. The ceramic parts, alumina or zirconia, were made by dry-pressing and firing to 1675°C. Zirconia was more satisfactory for $BaTiO_3$ because there were no detectable reactions between the two materials, while slight reactions occurred between alumina and some samples. A commercial, controlling-recording potentiometer was used to control the heating

coil, 60 feet of 0.037-inch-diameter Pt–20% Rh wire. A commercial preamplifier was used to amplify the differential emf for the "x" axis of an X-Y recorder. The heating rate could be varied from 1°C/min to 12°C/min. The cooling rate could also be controlled. (auth)

11173
AN ULTRASONIC SCANNING AND RECORDING SYSTEM. W. J. McGonnagle and W. N. Beck (Argonne National Lab., Lemont, Ill.). Am. Soc. Testing Materials 56, 1415-23 (1956).

Ultrasonic techniques have been used as a nondestructive test to differentiate between areas of intimate metal-to-metal contact with no bond and areas where two metals are fused together in a metallurgical bond. A test program was undertaken at Argonne National Laboratory to test nondestructively a large number of laminated metallic specimens. Since some of the specimens to be tested are less than 0.100 in. in thickness, it is necessary to use a two-crystal through-transmission technique. The purpose of this paper is to describe a scanning and recording system developed to test for defects and lack of bonding in plate and cylindrical type specimens, using the ultrasonic transmission technique. (auth)

PUMPS

11174 HW-49545 A
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FLOW GENERATION, MEASUREMENT, AND CONTROL. J. Dunn and H. M. Jones. Apr. 8, 1957. 30p. [Contract W-31-109-Eng-52]. $0.25(OTS).

The design criteria for equipment in a flow generation, measurement, and control system in a remotely operated aqueous separations plant are presented. Submerged regenerative turbine and deepwell turbine pumps, driven by motors located above and sealed from the tanks, are used to transfer solutions. Improved materials of construction, seal design, and methods of remote replacement have made it possible to adapt these pumps for use in chemical separations service. A brief description of a typical flow system installation, consisting of a specially designed rotameter-transmitter and control valve is presented. A detailed description of the rotameter-transmitter, amplifier-converter, recorder-controller, and control valve then follows. A description is given of a weight factor and specific gravity measurement system used for determining the volume of liquid moved into or out of a vessel which is helpful in calculating flow rate. (auth)

WASTE DISPOSAL

11175 UCRL-4891
California. Univ., Livermore. Radiation Lab.
RADIOACTIVE WASTE PROCESSING AND DISPOSAL (1950-1957) BIBLIOGRAPHY. Frederick E. Frost. May 6, 1957. 23p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

This bibliography consists of reports compiled from the AEC Library Card Catalog. Only the classified and unclassified report literature is included. For the published literature the reader is referred to an unpublished paper by M. Cason (UCRL–Livermore Library). All progress reports covering the work on radioactive waste disposal have been omitted in order to exclude a large amount of duplicate information which is usually found in more detail in topical reports. For information prior to Jan. 1, 1950, it is suggested that the reader refer to TID–3008–Radioactive Waste Processing and Disposal, H. E. Voress and Fred E. Croxton, Aug. 1, 1951 (Secret). The references are arranged by report number under disposal of wastes or processing of wastes. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

11176 NP-6364
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
A METHOD OF COMPARING REAGENTS USED AS AIDS TO PULP SUSPENSION IN AGITATION. H. H. McCreedy. May 31, 1957. 29p. (TR-143/57).

The use of flocculants as pulp suspending agents to counteract problems due to settling out and packing of coarse sands in leach agitators has been adopted by U mill operators in the Blind River area of Ontario. With the considerable variety of reagents of this type now on the market, it was desirable that a study be made as to how various reagents might be compared with respect to their use for this particular purpose. It has been found that a simple test based on the pull required to lift a disc on which solids from a pulp have been allowed to settle for a given interval shows significant differences between reagents. (auth)

11177 WAPD-ADC-115
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TRANSPORT AND DEPOSITION TRACER STUDIES IN A STATIC AUTOCLAVE. T. S. DeFail, Y. Solomon, and B. G. Schultz. Apr. 25, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

The rate of transfer of activity between a radioactive source and various nonradioactive materials under static, high temperature conditions was studied. Two types of experiments have been completed. In the first type, nonactive carbon and stainless steel specimens were arranged about on irradiated carbon steel source. The assembly of source and specimens was placed in a gold-lined autoclave containing high-purity degassed water. The contents of the autoclave were maintained at 500°F for a predetermined time period. Runs of 250, 500, and 1000 hours were conducted. Specimens were distributed so that exposures of 250, 750, 1000, and 1750 hours were obtained. The rate of transfer of activity to the specimens as a function of time was observed. In the second type of experiment, radioactive specimens having active surfaces as a result of transfer were placed into a stainless steel autoclave and heated. The amount of activity transferred from these specimens was observed as a function of the inert materials in the autoclave. (auth)

CERAMICS AND REFRACTORIES

11178 NP-6361
New Jersey. Ceramic Research Station, New Brunswick
TECHNICAL REPORT NO. 4 [FOR] JUNE 15, 1955–OCTOBER 15, 1956. 25p. Project NR-032-348. Contract N-onr-404(03).

Ceramic radomes have been successfully made of a 90% alumina body. They are fabricated by the slip casting process using material processed by the calcined body techniques; the firing temperature is 2800°F. All machining to the close dimensional tolerance (± 0.001 in.) has been accomplished with conventional lathes and diamond grinding wheels. (auth)

11179 NP-6365
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS. Quarterly Reports No. 1 through 8. Period Covered: March 15, 1955 to March 15, 1957. 262p. Project A-212. Contract NOrd-15701.

Methods of applying protective metal and ceramic coatings to metals were investigated. The methods included arc evaporation, hot dipping, cementation, vapor deposition, thermite firing of ceramics, and carbon-arc spraying. (T.R.H.)

11180 NP-6369
Alfred Univ., Alfred, N. Y.
STUDY OF HEAT TRANSFER OF CERAMIC MATERIALS. Final Report [for] January 1, 1955–April 30, 1957. 93p. Contract Nonr-1503(02).

A modified Angstrom method was selected over an internal friction method for the measurement of thermal diffusivity of Al_2O_3. The values for commercial polycrystalline Al_2O_3 ranged from 5.06 to 0.0073 cm^2/sec with temperatures from 84 to 639°K. For a like specimen of mullite the values ranged from 0.076 to 0.008 cm^2/sec from 82° to 355°K. Also measured was the change in infrared transmission of sapphire, single crystal Al_2O_3, vs. temperature. The values are given from 25° to 1500°C using monochromatic radiation, wavelength in the interval 1.0 to 7.0 μ, and from 25° to 1790° using total radiation in the wavelength range 0.5 to 7.5 μ. (T.R.H.)

11181 WADC-TR-53-193(Pt. II)
North Carolina State Coll., Raleigh.
VIBRATORY COMPACTING OF METAL AND CERAMIC POWDERS. Period Covered: April 20, 1953 to April 20, 1954. W. C. Bell, R. D. Dillender, H. R. Lominac, L. W. Long, and E. G. Manning. Apr. 1954. 80p. Task title: "CERAMIC AND CERMET RESEARCH." Contract AF-33(616)-73. (AD-51056).

This investigation has been primarily concerned with the low-frequency vibratory forming of alumina, nickel–titanium carbide, and chromium–alumina powders. The influence of a wide variety of particle size distributions of the powders on the forming, sintering, and physical properties of these compositions has been studied. An instrumentation system was developed for measuring the vibratory forces employed. Results obtained with the use of a wide range of low-frequency vibratory forming techniques are reported. Similar compositions were formed by dry pressing followed by hydrostatic repressing and the properties of the specimens formed by the two methods have been compared. The vibratory forming method was found to offer a number of advantages over the hydrostatic method. (auth)

11182 AEC-tr-3014
SOME PHYSICOCHEMICAL PROPERTIES OF ALLOYS OF ZIRCONIUM WITH CARBON. G. V. Samsonov and N. S. Rozinova. Translated from Izvest. Sektora Fiz. Khim. Anal. Inst. Obshchei Neorg. Khim. Akad. Nauk S.S.S.R. 27, 126-32(1956). 9p.

CORROSION

11183 APAE-Memo-44
Alco Products, Inc., Schenectady, N. Y.
CORROSION OF FUEL ELEMENT MATERIALS FOR A LOW ENRICHMENT POWER REACTOR. A. L. Medin and R. J. Clark, Jr. Aug. 1, 1956. Decl. July 3, 1957. 175p. Contract DA-44-009-Eng-2868.

To determine their possible use as fuel element material, an evaluation was made of the corrosion characteristics of Al, Zr, stainless steel and their alloys. The corrosion behavior of these metals under conditions that would prevail in a low enriched water cooled and moderated reactor of the APPR is as follows: Zircaloy-2 and 3 are more suitable for reactor application than crystal bar Zr. The average corrosion rate for Zircaloy-2 in 500°F water is 0.05 mg/cm^2/mo. Stainless steel was the most corrosion resistant material investigated; its corrosion rate in 500°F water averages 0.04 mg/cm^2/mo. Commercial 2S Al is unsatisfactory above 400°F. However, when alloyed with Ni or Cu, or plated with Ni, corrosion rates are significantly reduced. In 500°F water (pH-7) the corrosion rate of Al–1% Ni and Al–6% Cu alloys is approximately 0.9 mg/cm^2/mo (1.5 mils/yr) at a flow rate of 6 fps. Generally, corrosion rates of all these metals vary considerably with changes in temperature, flow rate, pH and other conditions. (auth)

11184 KAPL-1811
Knolls Atomic Power Lab., Schenectady, N. Y.
EFFECT OF WELDING ATMOSPHERE AND PICKLING ON THE CORROSION RESISTANCE OF WELDED ZIRCALOY-2 AND -3. K. H. Koopman, W. S. Horton, A. B. Riedinger, S. A. Toftegaard, and A. P. Jordan. Aug. 8, 1957. 29p. Contract W-31-109-Eng-51. $0.25(OTS).

The work described was performed primarily to determine the effects of welding atmosphere purity and postweld pickling on the corrosion resistance of welds in Zircaloy-2 and -3. The effect of joint design was also investigated. Corrosion tests were conducted in autoclaves in 680°F water. Results of this investigation definitely indicated that the best corrosion resistance was obtained with the highest purity gas shielding conditions. The effect of atmosphere was more pronounced in welds made with a high heat input and integral backing than in welds made at a low heat input. Repickling after welding resulted in no improvement in corrosion resistance of welds made in the purest atmosphere, but improved corrosion resistance when the poor atmospheres were used. However, pickling solution which became entrapped in crevices formed by the backing pads caused increased corrosion. There were indications from this experiment that some atmosphere condition between the best, i.e., the vacuum chamber, and a flushed inert-gas chamber might be suitable. Further work is recommended to determine the atmosphere conditions more closely. (auth)

11185 KAPL-M-DCB-2
Knolls Atomic Power Lab., Schenectady, N. Y.
THE CORROSION BEHAVIOR OF VARIOUS STAINLESS STEEL BORON ALLOYS IN 680°F WATER FOR USE AS A POSSIBLE BURNABLE POISON ELEMENT. Donald C. Belouin. May 28, 1957. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Burnable poison specimens of stainless steel containing up to 0.96 wt. % B were exposed to high purity water at 680°F (2700 psi). The results indicate that neither the fabrication methods used or B additions within the range investigated alter the corrosion resistance of unalloyed stainless steel. (auth)

11186 NP-6355
Naval Research Lab., Washington, D. C.
PITTING IN FERROUS SYSTEMS. Annotated Bibliography No. 11 [Covering the Period 1866–March 1957]. Mildred Benton, comp. June 1957. 128p.

A literature survey of pitting in ferrous systems was undertaken in connection with a study of the mechanism of pit formation in steel boiler tubing subjected to contact with dissolved oxygen at elevated temperatures. (auth)

11187 WAPD-ADC-96
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DEPOSITION OF CORROSION PRODUCTS UNDER IRRADIATION. G. P. Simon, B. G. Schultz, and Y. Solomon. Mar. 1, 1957. 21p. $4.80(ph OTS); $2.70(mf OTS).

The results are given from runs in which $Fe(OH)_2$ and carbon steel tubes were used as corrosion product sources. For comparison purposes, single runs were made using magnetite and crud from Bettis Test Facility(BTF). Ionizing radiation definitely results in the deposition of "freshly-produced" corrosion products. The form of the corrosion products most efficiently deposited from loop water is colloidal or soluble. Since both particulate corrosion products and Fe^{2+} are not efficiently deposited, the mechanism of partial hydrolysis and oxidation to form a colloid which reacts with radicals, produced by ionizing radiation, to produce deposition is supported. The amount of deposition under irradiation is a function of the amount of colloidal or soluble corrosion products available. With irradiation, a larger average percentage of iron was deposited during the low velocity runs. However, due to the variation between runs, a statistical analysis indicates that this difference is not significant at the 95% confidence level. (auth)

GEOLOGY AND MINERALOGY

11188 GS-B-1019-F
Geological Survey.
SELECTED ANNOTATED BIBLIOGRAPHY OF THORIUM AND RARE-EARTH DEPOSITS IN THE UNITED STATES INCLUDING ALASKA. (References to September 1954). Katharine L. Buck. 1957. 28p., 1 illus. $0.40(GPO).

The selected annotated bibliography includes books, articles, and other publications generally available in September 1954 on thorium and rare-earth deposits in the United States including Alaska. Many general papers are also included. Entries are arranged alphabetically by author. The index to the bibliography cross references the authors' listing by locality and subject. An effort has been made to include in the bibliography references to those deposits which produce or may produce thorium and (or) the rare earths and to exclude those references dealing with minor occurrences of primarily mineralogic interest; however, the extensive Bibliography and Index of Literature on Uranium and Thorium and Radioactive Occurrences in the United States by Margaret Cooper (1953, 1954) does include references to such minor occurrences of thorium-bearing minerals and many rare-earth-bearing minerals. The index maps show those deposits in the United States including Alaska for which information was available in September 1954 and which may produce, or have produced, thorium and (or) rare-earth-bearing minerals either as principal products or byproducts. The type of deposit is indicated by symbol, and the presence of important amounts of thorium or the rare earths is indicated by letters. The name of the mining district or area of the deposits is included on the map. (auth)

11189 GS-B-1059-A
Geological Survey.
SELECTED ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY OF URANIUM-BEARING COAL AND CARBONACEOUS SHALE IN THE UNITED STATES. Thomas M. Kehn. 1957. 30p. $0.25(GPO).

This annotated bibliography of literature and open-file reports dealing with uranium in coal and associated carbonaceous shale in the United States includes nearly all pertinent reports published or in preparation as of June 1955. In addition, several foreign references are listed which have contributed to the study of the origin and distribution of uranium in coal and lignite. Most of the coal beds and associated carbonaceous shales in the United States are practically nonradioactive, but many have been found during the past few years that assay from 0.005 to about 0.10 percent uranium; the concentration is greater in the ash. Investigations suggest that coal of lignite rank contains the most uranium; that coals of subbituminous B and C ranks contain the next largest concentration; and that only rarely do the higher rank coals contain more than 0.001 percent uranium. Lignite containing more than 0.10 percent uranium recently has been found in the northern Great Plains. Economic utilization of the large low-grade reserves of uranium in coal is partly dependent upon the use of the coal as fuel and the recovery of uranium from the ash as a byproduct. The stratigraphic nomenclature in this report is that used by the various authors and does not necessarily conform to the nomenclature of the U. S. Geological Survey. (auth)

11190 GS-B-1059-B
Geological Survey.
SELECTED ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY OF URANIUM-BEARING PHOSPHORITES IN THE UNITED STATES. Selected Bibliographies of Uranium Geology. Diane Curtis. 1957. 30p. $0.20(GPO).

This bibliography consists primarily of annotations of published reports and open-file reports of the Geological Survey pertaining to the geology of U-bearing phosphorites: a few general papers on the geology of domestic phosphates are included. The references are numbered and are listed alphabetically by author. The stratigraphic nomenclature as used in the bibliography is that of the various authors and does not necessarily correspond to the U. S. Geological Survey usage. Each locality or general area mentioned in the annotations is assigned a number—for example, Locality 23, Western phosphate field. The localities are listed numerically and are shown on the index maps; the locality number precedes the corresponding area in the key to localities. (auth)

11191 RME-1073(Rev.)
Denver Area Office, AEC.
AIRBORNE RADIOMETRIC SURVEY IN THE LEMITAR-LADRON AREA, NEW MEXICO. Glendon E. Collins and Burton C. Smith. June 1956. 10p. $0.15(OTS).

Three areas of Tertiary sedimentary and igneous rocks in northwestern Socorro County, New Mexico, were covered by an airborne radiometric survey in April 1955. The survey failed to reveal any new areas of anomalous radioactivity. (auth)

11192
EFFECTS OF RADON IN DRILL HOLES ON GAMMA-RAY-LOGS. L. S. Hilpert and C. M. Bunker (U. S. Geological Survey, Grand Junction and Denver, Colo.). Econ. Geol. 52, 438-55(1957) June–July.

Drill holes in uranium deposits in the Todilto limestone of Late Jurassic age near Grants, New Mexico, do not yield duplicate gamma-ray logs when probed at different times; some logs show equivalent uranium greatly in excess, in thickness and grade, of the chemical and laboratory radiometric analyses. Radon and its daughter products principally cause the discrepancies. Experimental work was undertaken to learn the relations of the radon to the uranium deposits and its behavior under different physical conditions. The work is based on the interpretation of about 600 gamma-ray logs, taken from 480 drill holes. Abnormally high amounts of radon, referred to here as contamination, ranged from barely detectable amounts to amounts

that emitted as much radiation as ore-grade material. Most contaminated holes were in the higher-grade ore, and the contamination increased with elapsed time after drilling. Geologic conditions favorable for contamination by radon and its daughter products in drill holes are: proximity to uranium deposits and fractured or highly permeable rocks above the water table. Most drill holes can be decontaminated by blowing them out with compressed air or filling them with water. Water, however, tends to reduce the thickness-time-grade figures below the amounts determined in air. (auth)

METALS AND METALLURGY

11193 AECD-3788

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FEASIBILITY SURVEY OF ZIRCONIUM AND ALTERNATE REACTOR STRUCTURAL MATERIALS FOR HIGH TEMPERATURE OPERATION. S. H. Bush and R. S. Kemper. Nov. 18, 1953. Decl. with deletions Dec. 5, 1955. 40p. Contract W-31-109-Eng-52. $0.30(OTS).

The properties of Al, Al–Mg, sintered Al powder, Zr, type 347 stainless steel, and Zircaloy-2 are examined. The materials are compared for their suitability as slug jacket and process tube materials in a high-temperature high-pressure system. Physical properties, tensile properties, creep properties, impact properties, macroscopic cross sections, radiation effects on properties, and effect of H_2 content on properties of the materials are tabulated. (T.R.H.)

11194 AECU-3528

Illinois. Univ., Urbana.

DIFFUSION IN METALS. Progress Report and Publication List. Frederick Seitz and David Lazarus. June 1, 1957. 18p. Project No. 3. Contract AT(11-1)-67. $3.30(ph OTS); $2.40(mf OTS).

The rate of diffusion of Ag^{110} and Au^{198} in Cu was determined. To study the isotope effect in metallic diffusion, the rates for Fe^{59} and Fe^{55} in Ag were measured. The chemical gradient effect in diffusion was investigated using Ag–α AgCd couples. Experiments in self-diffusion continued with Ag–Cd and Ag–In alloys. (See also AECU-3264.) (T.R.H.)

11195 AECU-3532

Sandia Corp., Albuquerque, N. Mex.

TITANIUM. K. E. Mead. May 13, 1957. 25p. Contract AT(29-1)-789. (TM-45-57-16). $4.80(ph OTS); $2.70(mf OTS).

Titanium-base materials are gaining wide interest in the field of moderate temperature applications. This report reviews the general characteristics of titanium base materials with emphasis on the four most commonly used alloys. The information is based on a review of technical and manufacturers' literature. Samples of these materials and additional technical information are available. (auth)

11196 BMI-1183

Battelle Memorial Inst., Columbus, Ohio.

STUDY OF ALUMINUM ALLOYS CONTAINING UP TO 45 w/o URANIUM. Norman E. Daniel, Ellis L. Foster, John A. DeMastry, Arthur A. Bauer, and Ronald F. Dickerson. Apr. 30, 1957. Decl. June 4, 1957. 40p. Contract W-7405-eng-92. $6.30(ph OTS); $3.00(mf OTS).

Casting techniques for the production of sound homogeneous extrusion blanks composed of aluminum–uranium alloys with 30 to 45 wt. % uranium were investigated. Satisfactory extrusion blanks in the form of sleeve castings containing 30 wt. % uranium were produced utilizing air-melting techniques. Sound castings 2 in. in diameter containing 45 wt. % uranium were produced by conventional vacuum-melting techniques utilizing zirconia crucibles. An extrusion blank containing 45 wt. % uranium with side walls 0.55 in. thick was vacuum melted and cast. This casting was essentially sound, porosity being found only in the area of the pour, and was attributed to problems in mold design. As a supplement to the casting program, exploratory investigations were made of the fabricability and the corrosion resistance of the alloys. The diffusion rate of the uranium from the alloys into 2S aluminum cladding was also studied. All of the alloys, enclosed in heavy-walled-aluminum tubes, were press forged at 800 and 1000°F. The corrosion resistance of the high-uranium alloys is comparable to that exhibited by the aluminum–16 wt. % uranium alloy, and diffusion of the uranium from the alloys into 2S aluminum after 30 days at 750°F could not be detected by metallographic techniques. The effects of a 0.5 wt. % silicon addition on the melting characteristics of the aluminum–16 wt. % uranium alloy were negligible when compared with the effects of small variations in the uranium content. (auth)

11197 HW-50670

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN EVALUATION OF THE ALUMINUM LINED ZIRCALOY TUBE CONCEPT. Dale E. Johnson. June 10, 1957. 23p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

The use of Al lined Zircaloy process tubes in organic cooled reactors is not practical unless an extensive development program is established. Within the limits of experimental error the dimensional change of the Al liners were closely comparable with the calculated dimensional changes. (auth)

11198 KAPL-M-JMG-9

Knolls Atomic Power Lab., Schenectady, N. Y.

BRAZING OF ZIRCALOY 3 FOR TEMPERATURE INSTRUMENTED PROBES. J. M. Gerken. May 1, 1957. 11p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

None of the brazing materials tested in this program was considered satisfactory for brazing Zircaloy for service in high temperature pressurized water. The Ti + 1% Sn and Ti + 2% Sn brazing materials produced joints having good strength and ductility but both disintegrated completely in corrosion test. The Cu–Pd–In alloy, which apparently corroded the least of the alloys tested, was extremely brittle and therefore was considered unsuitable from a mechanical standpoint for many types of joints. (auth)

11199 KAPL-M-JMG-10

Knolls Atomic Power Lab., Schenectady, N. Y.

DIFFUSION BONDING OF ZIRCALOY TO STAINLESS STEEL TUBING. J. M. Gerken. May 28, 1957. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Satisfactory diffusion bonds can be made between $\frac{7}{8}$ in. O.D. × $\frac{1}{8}$ in. wall stainless steel and Zircaloy tubing. These joints did not fail after thermal cycling 200 times between 100 and 600°F or after pressure cycling 100 times between 100 and 3500 psi. Hydraulic bursting pressures of from 13,200 to 17,200 psi were required to cause failure of well-bonded joints. Failure generally occurred by the Zircaloy tube splitting longitudinally and peeling away from the joint. (auth)

11200 KAPL-M-RFL-8

Knolls Atomic Power Lab., Schenectady, N. Y.

MACROSCOPIC EXAMINATION OF ZIRCALOY 3A AND

ZIRCALOY 2 PRIMARY EXTRUSION BILLET MATERIAL. R. F. Lupi. May 3, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

Surface and internal quality of $3^5/_8$ in. diam. and $2^5/_8$ in. diam. forged bar stock primary extrusion of rod and tubing for fuel elements was determined for a period of four months. In that time 27 billets were examined comprising three different groups of materials. Approximately 22% of the billets inspected were found to contain defects consisting of surface cracks, internal cracks, and porosity. The defects were found to be mechanical in nature resulting from forging practice used to convert the ingots to rod. Photographs of typical defects are included. (auth)

11201 KAPL-M-RLM-12
Knolls Atomic Power Lab., Schenectady, N. Y.
TENSILE PROPERTIES AND METALLOGRAPHIC STUDY OF ZIRCALOY 3 STRIP. R. L. Mehan. June 13, 1957. 56p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60 (mf OTS).

Room-temperature tensile tests and metallographic examination were performed on zircaloy-3 strip of two different thicknesses, 0.065 and 0.185 in., from eleven different ingots. Pronounced anisotropic effects were found, increasing with the smaller thickness. No noticeable effect of microstructure on tensile properties was found. Tabulations and statistical reductions of the data are presented. (auth)

11202 MAB-119-M
National Research Council. Materials Advisory Board.
WORK SHEETS BY THE SUBPANEL FOR FORMULATION OF DEVELOPMENT PROGRAMS RELATED TO ROLLING BEHAVIOR OF THE PANEL ON TITANIUM SHEET ROLLING PROGRAM. June 12, 1957. 48p. Contract DA-49-025-sc-83.

11203 ML-398
Stanford Univ., Calif. Microwave Lab.
ELECTROFORMING OF LINEAR ACCELERATOR STRUCTURES. James A. Pope. June 1957. 22p. Contract Nonr 225(06) Project NR-022-166.

Equipment and techniques used for the electroforming of copper linear electron accelerator structures are described. Electroforming of these structures is preferred over mechanical fabrication techniques because it allows baking of the structure at high temperatures for purposes of outgassing and subsequent sealing-off of the vacuum-tight accelerator tube. The electroforming procedure also offers the advantage of a stress-free final structure, in contrast to mechanical fabrication, and therefore provides a greater degree of dimensional stability which is of great importance in accelerator operation. Other advantages include the ability to fabricate long accelerator sections with good accuracy and the relative ease of fabricating accelerator structures of non-uniform dimensions. (auth)

11204 NACA-TN-4049
Michigan. Univ., Ann Arbor.
INFLUENCE OF CRUCIBLE MATERIALS ON HIGH-TEMPERATURE PROPERTIES OF VACUUM-MELTED NICKEL–CHROMIUM–COBALT ALLOY. R. F. Decker, John P. Rowe, and J. W. Freeman. June 1957. 34p.

A study of the effect of induction-vacuum-melting procedure on the high-temperature properties of a titanium- and aluminum-hardened nickel-base alloy revealed that a major variable was the type of ceramic used as a crucible. Reactions between the melt and magnesia or zirconia crucibles apparently increased high-temperature properties by introducing small amounts of boron or zirconium into the melts. Heats melted in alumina crucibles had relatively low rupture life and ductility at 1,600°F and cracked during hot-working as a result of deriving no boron or zirconium from the crucible. (auth)

11205 NACA-TN-4074
Langley Aeronautical Lab., Langley Field, Va.
COMPRESSIVE STRESS-STRAIN PROPERTIES OF 17-7 PH AND AM 350 STAINLESS-STEEL SHEET AT ELEVATED TEMPERATURES. Bland A. Stein. Aug. 1957. 21p.

Results of compressive stress-strain tests on 17-7 PH and AM 350 stainless-steel sheet in the heat-treated and in the annealed conditions are presented for temperatures up to 1,200°F. The 17-7 PH stainless steel was heat-treated to Condition TH 1,050; the AM 350, to the double-aged condition. Representative compressive stress-strain curves are given for each material at the test temperatures. From these curves significant data such as 0.2-percent-offset yield stress, Young's modulus and secant and tangent moduli are presented. (auth)

11206 NAVORD-4237
Naval Ordnance Lab., White Oak, Md.
APPLICATIONS, PROPERTIES, AND FABRICATION OF THERMENOL TYPE ALLOYS. J. F. Nachman and W. J. Buehler. May 4, 1956. 51p.

The properties of Thermenol (Fe–Al–Mo), a non-strategic high-temperature and magnetic alloy, are discussed. These include hardness, tensile, stress-rupture, corrosion, oxidation resistance, and magnetic properties at room temperature and elevated temperature. Preparation of the alloy and methods of hot and cold working are also described. Suitable applications for a material of this type are listed. (auth)

11207 NP-6368
Aeroprojects Inc., West Chester, Penna.
THE APPLICATION OF ULTRASONIC ENERGY TO COLD WELDING OF METALS. Final Research Report No. 53-77. J. Byron Jones and Carmine F. DePrisco. Nov. 1953. 61p. Project No. TB4-31G-3. Contract DA-36-034-ORD-1007.

Equipment was devised and experiments were carried out in the ultrasonic spot and seam welding of non-ferrous sheet material in 0.005" and 0.010" gages without the use of elevated temperatures. Ultrasonically spotwelded 2S Al developed adequate strength and pressure-sealing characteristics in reasonable ultrasonic exposure time and at reasonable power levels. Internal deformations of the faying surfaces were present, but no comparable external indentation occurred. No corrosion effects were evident after 2000 hr of exposure to salt water or to aerated distilled water at 95°C. Preliminary experiments indicated that other metals, particularly brass, Cu, and gilding metal, can be ultrasonically welded. It is recommended that the process be further developed to establish relationship between ultrasonic parameters and material properties, and to encompass heavier gages and other materials. (auth)

11208 NP-6370
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
TABULAR SUMMARY OF THE NOTCHED AND UNNOTCHED FATIGUE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. W. P. Achbach and J. G. Weinberg. May 14, 1957. 33p.

11209 NP-6371
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
STRESS RELIEF, ANNEALING, AND REACTIONS WITH ATMOSPHERE OF TITANIUM AND TITANIUM ALLOYS. D. J. Maykuth. May 24, 1957. 44p.

A brief review of the origin of residual stresses is given. Also some of the most commonly observed effects of such stresses in Ti and its alloys are described. Data from a number of sources were gathered to furnish a guide for the selection of stress-relief and annealing treatments on various Ti bar and sheet alloys. The reaction of atmospheric gases and H_2 with Ti and Ti alloys is discussed. (W.L.H.)

11210 NP-6372

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE AVAILABILITY OF TITANIUM TUBING, DUCTING, AND FITTINGS. Oren J. Huber. June 13, 1957. 9p.

11211 NP-6373

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

APPLICATIONS AND REQUIREMENTS FOR TITANIUM CASTINGS. W. H. Johnson. June 19, 1957. 5p.

Information is given on up to date applications and requirements for Ti castings as expressed by the potential users. The items covered include the quantity, mechanical properties, size, price, alloy development, surface contamination, surface finish, and opinions on the future establishment of a Ti casting industry by 1960. (auth)

11212 NP-6376

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

SPINNING OF TITANIUM AND ITS ALLOYS. May 6, 1957. 5p.

The spinning process for fabrication of various shapes of Ti and Ti alloys is described, and techniques for more effective production and the temperatures required by the process are given. (R.V.J.)

11213 NP-6377

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

EFFECT OF COMPOSITION AND HEAT TREATMENT ON THE UNIFORM ELONGATION AND FLOW PROPERTIES OF ALPHA-BETA TITANIUM ALLOYS. A. J. Giest, H. A. Robinson, and P. D. Frost. Apr. 30, 1957. 13p. Contract AF33(616)-2901.

The flow characteristic and uniform elongation of α-β Ti alloys in the solution-treated condition were shown to be markedly affected by the solution temperature. The uniform elongation of martensitic alloys decreased as the solution temperature was initially increased, but increased again at higher temperatures. Nonmartensitic α-β alloys, on the other hand, showed a continuous decrease of uniform elongation with increasing solution temperature. The behavior was rationalized in terms of the α-β ratio and the alloy content of the beta existing at the solution temperature. The uniform elongation was lower the greater the amount of metastable beta in the microstructure. A close control of the solution temperature may attain maximum uniform elongation, and, hence, maximum formability in solution-treated sheet. (auth)

11214 NP-6379

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

STATUS OF ELECTROPLATED METAL COATINGS ON TITANIUM. John G. Beach. May 10, 1957. 13p.

A summary is given of data on electroplated metal coatings on titanium. References are given on the electroplates of Al, Cu, Sn, Pb, Ag, Au, Cr, Ni, Ni–P alloy, Cd, Co, Fe, and Zn. Evaluations of plated coatings on Ti in wire drawing, roll cladding, soldering, forging, and various parts such as camera shutter blades, aircraft gears, bearings, guns, hydraulic cylinders, and landing gears are presented in tabular form. (R.V.J.)

11215 NP-6384

Battelle Memorial Inst., Columbus, Ohio.

THE EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES OF TITANIUM–ALUMINUM ALLOYS. Summary Report [for] May 1, 1956 to April 30, 1957. L. W. Berger, D. N. Williams, and R. I. Jaffee. Apr. 30, 1957. 39p. Project No. TB 4-15. Contract DA-33-019-505-ORD-7.

Studies were made of the effects of hydrogen on the properties of Ti–Al alloys containing 2.5, 5, and 7% Al and Ti–Al alloys containing O, N, and C. The results showed that an increase of Al increases the hydrogen solubility which enables the alloys to contain higher amounts of hydrogen before the hydride occurs in the structure and impact embrittlement takes place. The alloy showed good weldability and high notch toughness at moderate strength levels. (R.V.J.)

11216 NP-6385

Case Inst. of Tech., Cleveland.

MATRIX AND DEFORMATION BAND ROTATION DURING EXTENSION OF ALUMINUM CRYSTALS. Final and Technical Report No. 35 [on] THE EFFECTS OF STRESS CONCENTRATION AND TRIAXIALITY ON THE PLASTIC FLOW OF METALS. J. T. Brown and W. M. Baldwin, Jr. May 1957. 35p. Project NR-031-049. Contract N6-onr-273/1.

Tension tests were made on single and bicrystals of Al of various cross sections having the [011] direction as the tensile axis. In every case, the tensile axis referred to the matrix of the crystals rotated toward the $[\bar{1}11]$ direction instead of the $[\bar{1}12]$ direction predicted by classical crystal mechanics. At the same time one or more sets of deformation bands formed, the tensile axis of the material in each band rotating toward any one of the four classical directions $[\bar{1}12]$, $[\bar{1}21]$, [112], or [121] depending on the operating slip plane and direction. Explanations for these processes are presented. (auth)

11217 NP-6390

Clevite Research Center, Cleveland.

RESEARCH ON THE LUBRICATION OF TITANIUM. Quarterly Progress Report No. 5 [for] May 15, 1957 to August 14, 1957. N. Fatica. Aug. 14, 1957. 17p. Project 50167-G. Contract AF33(616)-3350.

The primary variables studied on the Falex tester are loading, duration of test, various titanium metals, and nature of the lubricant. The available data from the tester are analyzed and discussed. It is concluded that the pin wear rates are the most pertinent. Various lubricant possibilities have been examined from the point of view of possible beneficial mechanisms. These include materials that decompose at high temperatures to deposit an easily lubricated metal, materials potentially corrosive to titanium at elevated temperatures, materials containing Ti, highly volatile materials that could keep surface temperatures to a minimum, materials that may be worked into the surface by mechanical action, and miscellaneous mechanisms. The most effective systems tested to date are organic halogenated compounds and aqueous solutions of KF. (auth)

11218 OSR-TN-56-555

Brussels. Université. Laboratoire de Chimie Physique Moléculaire.

VAPORIZATION OF COMPOUNDS AND ALLOYS AT HIGH TEMPERATURE. Technical Note 1. Richard E. Honig and Jean Drowart. Oct. 1956. 37p. Contract AF61(514)-868. (AD-110374).

The rate-of-vaporization of Group IB (Cu, Ag, and Au) and of Group IIIB (Ga and In) was investigated in a 60° mass spectrometer. For Cu, Ag, and Au there were found not only the expected atomic species but also small concentrations of the dimers. The ionic ratios X_2/X_1 (about 10^{-3}) were measured over temperature ranges of about 100°K at pressures estimated to lie between 10^{-4} and 10^{-5} mm Hg. Dissociation energies were computed for the molecules Cu_2, Ag_2, and Au_2. Dissociation energies were computed for the Group IVB molecules C_2, Si_2, Ge_2, Sn_2, and Pb_2. (W.L.H.)

11219 TML-76

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

SURVEY OF EXPERIMENTAL FACILITIES FOR ROLLING THIN, WIDE, HIGH-STRENGTH, HIGH-TEMPERATURE MATERIALS FOR AIRCRAFT CONSTRUCTION. R. L. Carlson and C. H. Lorig. July 5, 1957. 36p. Contract AF18(600)-1375.

11220 WADC-TR-53-24(Pt. 4)

Cornell Aeronautical Lab., Inc., Buffalo.

INTERMITTENT STRESSING AND HEATING TESTS OF AIRCRAFT STRUCTURAL METALS. Period Covered: August 1954 to August 1955. John Salvaggi. Apr. 1957. 75p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contract AF33(616)-2226. (AD-118293).

Previous studies on the high-temperature creep and rupture behavior of a number of aircraft structural materials exposed to relatively simple intermittent-load or intermittent-heat test conditions emphasized the fact that each alloy system behaves in its own characteristic manner. Five of these materials, C-110M titanium, A-70 titanium, type 321 stainless steel, N-155 alloy, and 4130 steel were selected for further evaluation under the more complex conditions of combined intermittent temperature and load. Analysis of these test results disclosed little difference in creep and rupture behavior relative to the intermittent-load or intermittent-heat results. In general, the basic mechanisms or causes responsible for the behavior patterns noted in the simpler environments of constant-temperature intermittent-load and constant-load intermittent-temperature are relatively unaffected by the phase relationships of the combined cyclic-load and temperature test conditions utilized in this study. (For preceding period see WADC-TR-53-24(Pt. 3).) (C.H.)

11221 WADC-TR-55-207

Rensselaer Polytechnic Inst., Troy, N. Y.

MAGNESIUM ALLOYS WITH HIGH MELTING POINT ADDITIONS. Period Covered: February 1, 1954 to January 31, 1955. R. R. Nash, H. K. Adams, Jr., A. E. Bibb, Jr., M. C. Huffstutler, and E. J. Tulloch. Mar. 15, 1955. 196p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF33(616)-2312. (AD-118122).

An exploratory investigation was made to determine the alloying characteristics and the influence on microstructures, mechanical properties and resistance to corrosion of small additions of Ti, Hf, Ta, Ni, Co, V, B, Cr, Y, Re, Nb, W and Mo to Mg and to selected Mg-base alloys. (auth)

11222 WADC-TR-56-319

Battelle Memorial Inst., Columbus, Ohio.

A SURVEY OF THE LITERATURE ON RHENIUM. Period Covered: June 1952 to January 1956. C. T. Sims, E. N. Wyler, G. B. Gaines, and D. M. Rosenbaum. June 1, 1956. 235p. Project 7080. Contract AF33(616)-232. (AD-110596).

11223 WADC-TR-56-375

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

WEAR STUDIES WITH TITANIUM. Period covered: February 1955 to February 1956. Robert J. Benzing and Arthur N. Damask. Sept. 1956. 17p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANT MECHANICAL EVALUATION. (AD-110585; PB-121885).

A study of the wear of Ti using typical oils was made on the Falex Wear Tester and the Shell Four-Ball Wear Tester. The purpose of this study was to provide data for comparison with other studies dealing in friction coefficients and wear of specimens in nonstandard lubricant testers. A mineral oil, diester, silicate ester, silicone, and halogenated hydrocarbon were the oils studied. C-130-AM, Ti-150A, and 3Al-5Cr alloys were used and both cyanided and uncyanided surfaces are included in the program. (auth)

11224 WADC-TN-57-231

Central Inst. for Industrial Research, Blindern, Oslo, Norway.

INVESTIGATION OF THE MECHANISM OF THE OXIDATION OF TITANIUM AND TITANIUM ALLOYS AT HIGH TEMPERATURES. Period Covered: October 1, 1955 to March 31, 1957. Per Kofstad. June 1957. 92p. Project No. 7022. Contract AF-61(514)-892. (AD-130779).

The results on oxidation of Ti in the temperature region 300 to 1000°C and a number of Ti alloys between 800 and 1000°C are reported. For Ti the following rate laws are observed in the indicated temperature regions: logarithmic rate law, < 300°C; cubic rate law, 300 to 600°C; parabolic rate law, 600 to 850°C; and parabolic + linear rate law, 900 to 1000°C. The observed rate laws also depend on the duration of the oxidation, and at any definite temperature the rate law will eventually change into the rate law corresponding to the following temperature region. Theoretically three rate laws during the same run should be observed, providing the oxidation is followed for the necessary length of time. The following mechanisms of oxidation are proposed: the logarithmic rate law is interpreted as an oxide film formation perhaps governed by a Mott-type mechanism; the cubic rate law is associated with a diffusion of oxygen into the Ti-metal; the parabolic rate law is interpreted in terms of the usual high temperature mechanism as described by Wagner; and the linear rate law results from cracks in the oxide scale due to stresses in the oxide and a phase boundary reaction being the rate determining reaction. Wagner-Hauffe's approach to alloy oxidation has been used as working hypothesis in order to improve the oxidation resistance of Ti. It is found that Ti with small alloying additions of Nb, Ta, and W, only improves the oxidation resistance by max. 50%. This approach has therefore not given the expected results. The difficulty in obtaining Ti alloys with appreciable oxidation resistance is due to the high oxygen solubility of Ti. (auth)

11225 WAL-401/277

Watertown Arsenal Labs., Mass.

AN EXPERIMENTAL STUDY OF TITANIUM WIRE-DRAWING FORCES. Frank R. Larson. June 1957. 59p. O. O. Project Title: METALS FOR LIGHT-WEIGHT CONSTRUCTION. D/A Project 5B93-08-021.

Experiments were conducted to determine the effect of die angle, drawing speed, percent reduction of area, and lubrication upon the forces encountered in the wire drawing of titanium A55 and titanium alloy C110M. Special dies of conical shape were used thereby simplifying the calculations. A method which allows for strain rate effects was

developed enabling the calculation of ideal draw forces based on tensile test results. Based on the actual draw forces measured, no one die angle showed superior performance. Furthermore, there was very little difference in the drawing behavior between the two materials studied when the results were rationalized on the basis of their tensile properties. The copperplate-zinc stearate lubricant showed superior antigalling and antiseizing properties to that of the phosphate-graphite lubricant. Superficial tests on other lubricants revealed that draw forces are very sensitive to the type of lubricant used. These tests showed that the draw force increased rapidly with increasing reduction of area, and that the drawing limit for A55 was in excess of 50% and for C110M was approximately 50%. Finally, the draw forces were shown to increase, with increasing speed, about 6 to 14 percent in the speed range of 0.02 to 2 inches per minute. Between 2 to 20 inches per minute, a transition in behavior was noted which generally resulted in lower draw forces at the higher speed. (auth)

11226 WAPD-A1W(PCh)-61

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

RESULTS OF EXAMINATION OF CARBON STEEL PIPE AND SMALL HEAT EXCHANGER REMOVED FROM NRTF. R. S. Gilbert. [1956?]. 10p. $1.80(ph OTS); $1.80(mf OTS).

To evaluate the pipe wall activity hazard when carbon steel is substituted for stainless steel, samples irradiated in the NRTF were examined. The difference in activity between the two was found due to the activity of loosely adhering deposits. It was also found that the difference in activity between the two does not change appreciably with time. (T.R.H.)

11227 WAPD-PWR-PMM-1053

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

HYDROGEN MIGRATION IN ZIRCALOY-2. B. Lustman. Mar. 12, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

Investigations of the cause and effects of H_2 migration under thermal gradients in Zircaloy-2 are presented. (W.L.H.)

11228 AEC-tr-2926

SELF DIFFUSION IN TANTALUM. P. L. Gruzin and V. I. Meshkov. Translated from Voprosy Fiz. Metal. i Metalloved. Akad. Nauk Ukrain. S.S.R. 570(1955). 3p.

The self-diffusion coefficients in Ta were determined at 1200, 1250, and 1300°C using Ta^{182} as tracer. Radioactive Ta was deposited on one of the surfaces of a nonradioactive Ta specimen which was in the form of a parallelopiped. Two samples, with their active faces towards each other, were sealed in quartz ampoules and given diffusion anneals of 170 to 320 hr, depending on the temperature. The self-diffusion coefficients were measured by cutting layers and measuring the remaining integral activity of the specimens. (L.T.W.)

11229 AEC-tr-2949

DIFFUSION OF BORON, CARBON AND NITROGEN INTO TRANSITION METALS OF IV, V, AND VI GROUPS OF THE PERIODIC TABLE. G. V. Samsonov and V. P. Latisheba. Translated from Doklady Akad. Nauk S.S.S.R. 109, 582 (1956). 4p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 11-1534.

11230 AEC-tr-2950

EVIDENCE OF A KIRKENDALL EFFECT IN THE DIFFUSION BETWEEN URANIUM–ZIRCONIUM IN THE γ PHASE. Yves Adda, Jean Philibert, and Claude Mairy. Translated by R. Misch from Compt. rend. 243, 1115(1956). 4p.

Evidence has been found of a very pronounced Kirkendall effect in the U–Zr diffusion in the γ phase. The displacement of markers located at the initial interface has been studied as a function of temperature and time of diffusion. The intrinsic coefficients of diffusion of U and Zr have been determined by the Darken relations. (auth)

11231 AEC-tr-2965

THE PREPARATION OF FUSED TANTALUM CARBIDE. V. I. Smirnova and B. F. Ormont. Translated from Zhur. Fiz. Khim. 26, 958-60(1956). 4p.

A method of melting compounds of the type of TaC possessing high melting points is discussed. The use of a compact apparatus for the solution of various problems connected with the investigation is reported. (auth)

11232 AEC-tr-2968

METALLOGRAPHY–THE APPLICATION OF AUTORADIOGRAPHY TO THE ANALYSIS OF URANIUM–ZIRCONIUM ALLOYS AND TO THE STUDY OF URANIUM–ZIRCONIUM DIFFUSION USING α RADIATION. Henriette Faraggi, Arlette Garin-Bonnet, Yves Adda, and Jean-Marie Henry. Translated by R. Misch from Compt. rend. 243, 1315(1956). 3p.

The relation between the α emission and the U content in a thick layer of U–Zr alloy was determined, and the relationship found was applied in the U–Zr diffusion studies. (R.V.J.)

11233 AEC-tr-2969

THE DIFFUSION OF LEAD IN LEAD TELLURIDE. B. I. Boltax and Yu. N. Mokhov. Translated from Zhur. Tekh. Fiz. 26, 2448(1956). 3p.

11234 AEC-tr-2971

ON THE ENERGY OF VACANCY FORMATION IN METALS AND ALLOYS. S. D. Gertzriken. Translated from Fiz. Metal i Metalloved. Akad. Nauk U.K.R. S.S.R. 3, 238(1956). 4p.

11235 AEC-tr-2972

THE MEASUREMENT OF DIFFUSION COEFFICIENTS BY THE METHOD OF CONTINUOUS MEASUREMENT. V. P. Vasil'yev. Translated from Doklady Akad. Nauk S.S.S.R. 110, 61(1956). 4p.

11236 AEC-tr-2980

LOW TEMPERATURE RECRYSTALLIZATION OF METALS. R. I. Garber, I. A. Gindin, V. S. Kogan, and B. G. Lazaryev. Translated from Doklady Akad. Nauk S.S.S.R. 110, 64(1956). 4p.

The present work was undertaken with the aim of a direct investigation of the microstructural changes in technical Fe (0.03% C) and Ni deformed at liquid N temperatures. The deformation of Fe at low temperatures takes place by slip and twinning, while Ni deforms only by slip, which explains its considerable plasticity under these conditions. The Fe and Ni were chosen as the objects of the investigation to allow observation of the roles played by the basic forms of plastic deformation, twinning, and slip in the creation of a nonhomogeneous crystal lattice during deformation and in the accomplishment of the recrystallization processes which depend on these inhomogenieties. Small-grained specimens, with an average grain dimension of 25 to 30 μ, and coarse-grained specimens, with an average grain dimension of 100 to 200 μ, were investigated. These were obtained from initial billets by the proper mechanical and thermal treatment. Deformation was accomplished either by rolling in rolls, allowing a reduction from 5 to 60% at liquid N temperatures, or by pressing a hardened steel ball through a fixed thin walled tube specimen contained in

liquid N. The degree of deformation of the tube was 5 to 14%. The specimens were submitted to x-ray analysis: in the initial state, directly after deformation in liquid nitrogen without heating to room temperature, and after 10 to 12 hr heating at room temperature. The back-reflection photograms were taken from the same place on the specimen with an Fe target fine focusing x-ray tube. A metallographic investigation of the structure of the specimens was carried out at the same time. The etched surfaces were viewed and photographed on a microinterferometric microscope. (auth)

11237

SEGREGATION AT THE EUTECTIC TEMPERATURE. B. C. Allen (Massachusetts Inst. of Tech., Cambridge) and S. Isserow (Nuclear Metals, Inc., Cambridge, Mass.). Acta Met. 5, 465-72(1957) Aug.

The segregation of the two solid phases in the crystallization from the eutectic liquid has been shown to be due to the difference in the densities of the phases involved. The segregation effect can be amplified by repeated cycles involving alternate heating and cooling through the eutectic temperature. Although checked in other systems, the effect was investigated most thoroughly in the uranium-aluminum system, where the density differences are unusually favorable for its manifestation. (auth)

11238

SIGMA PHASES CONTAINING OSMIUM AND IRIDIUM. M. V. Nevitt and J. W. Downey (Argonne National Lab., Lemont, Ill.). J. Metals 9, 1072(1957) Aug.

11239

THE EXISTENCE OF A FLADE POTENTIAL ON IRON INHIBITED BY IONS OF THE XO_4^{n-} TYPE. G. H. Cartledge and R. F. Sympson (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 61, 973-80(1957) July.

Halts approximately at the Flade potential were observed in the potential–time curves when the noble potential of electrolytic iron, initially inhibited by aerated pertechnetate, chromate, molybdate or tungstate solutions, was debased by addition of sodium sulfate. The behavior was similar to that observed by Bonhoeffer and co-workers in the activation of iron that had been passivated in nitric acid or by anodic treatment. The results support the theory that passivation by these means and inhibition under the conditions here studied produce surface films of essentially similar electrochemical character. (auth)

11240

EFFECTS OF COMPLEX STRESS-TIME CYCLES ON THE FATIGUE PROPERTIES OF METALS. W. L. Starkey and S. M. Marco (Ohio State Univ., Columbus). Trans. Am. Soc. Mech. Eng. 79, 1329-36(1957) Aug.

An investigation was conducted to determine the effects of complex stress-time cycles on the fatigue properties of metals. The uniaxial stresses studied were complex in the sense that their stress-time patterns may be analyzed as composed of several harmonic components. Four theoretical design methods, and the results of an experimental investigation involving complex stresses are presented. Comparisons are made of the test results with the theory predictions. (auth)

11241

THE SOLUBILITY OF THORIUM IN LIQUID ZINC. M. V. Smirnov, N. G. Ilyushchenko, et al. (Sverdlovsk, Academy of Sciences, Ural Div.). Zhur. Fiz. Khim. 31, 1013-8(1957) May. (In Russian)

Investigations were made of Th–Zn alloys containing up to 25% Th by wt. The phases of pure Zn and of metallic compounds of Th_2Zn_{17} were found. The Th was isolated from the alloy by dissolving the excess Zn in aqueous solutions of ammonium salts or in alkalis. The solubility of Th in liquid Zn was determined at 419 to 825°C. (R.V.J.)

Refer also to abstract 11170.

PHYSICS

11242 AECU-3524

General Electric Co. Specialty Electronic Components Dept., Auburn, N. Y.

HIGH ENERGY STORAGE CERAMIC CAPACITOR. Quarterly Report No. 1 [for] November 19, 1956–February 19, 1957. D. A. Lupfer. 49p. Contract AT(30-1)-1963. $7.80(ph OTS); $3.30(mf OTS).

Research is described for the development of ceramics suitable for use as dielectrics in capacitors capable of storing large amounts of energy in a small volume. The two materials selected for initial study are $BaTiO_3$–$SrTiO_3$ and $BaTiO_3$–$Bi_2(SnO_3)_3$. Work on materials, the problem of flaws, test sample design, and capacitor design is reported. (T.R.H.)

11243 AECU-3525

General Electric Co. Specialty Electronic Components Dept., Auburn, N. Y.

HIGH ENERGY STORAGE CERAMIC CAPACITOR. Quarterly Report No. 2 [for] February 19, 1957–May 19, 1957. D. A. Lupfer. 60p. Contract AT(30-1)-1963. $9.30(ph OTS); $3.60(mf OTS).

Work on the preparation of a void-free $BaTiO_3$–$SrTiO_3$ ceramic is described. The optical and electrical properties of the material were investigated, and sample preparation and testing continued. The casting, calcining, machining and firing procedure is given. (For preceding period see AECU-3524.) (T.R.H.)

11244 AECU-3541

Sandia Corp., Albuquerque, N. Mex.

SOME MEASUREMENTS OF ACCELERATION PRODUCED BY SOUND PRESSURES. Charles W. Remaley. July 17, 1957. 23p. Contract AT(29-1)-789. (TM-107-57-16). $4.80(ph OTS); $2.70(mf OTS).

The results of an experiment performed to determine the effects of sound pressure on acceleration of a test specimen are presented. Particular attention is given to determining the resonant frequency and amplitude of acceleration of the test specimen as a function of mass, sound pressure and frequency. (auth)

11245 AECU-3542

Sandia Corp., Albuquerque, N. Mex.

THE "ZERO DEGREE" ISOTHERMAL AND ICAO STANDARD ATMOSPHERES. T. Y. Palmer, H. J. Plagge, and F. O. Lane. Apr. 16, 1957. 21p. Contract [AT(29-1)-789]. (TM-176-57-52). $4.80(ph OTS); $2.70(mf OTS).

The variation of apparent gravity with altitude is incorporated in the hypsometric formula. New values of pressure altitudes for a zero degree centigrade isothermal atmosphere were then computed by the Elecom Model 125. The ICAO Standard Atmosphere, adopted November 20, 1952, and extended by ARDC, is also presented. (auth)

11246 AERE-C/R-403(App.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION AND MEANING OF PARTITION COEFFICIENTS. K. D. B. Johnson, G. L. Miles, K. Hyde, and M. Ward. [Sept. 1949]. Changed from OFFICIAL USE ONLY Nov. 9, 1956. 10p.

11247 ATI-166839
Temple Univ., Philadelphia. Research Inst.
THE ALUMINUM-SUN FURNACE; SECOND TECHNICAL REPORT [ON] HIGH TEMPERATURE PROJECT. Joseph B. Conway and Aristid V. Grosse. July 1, 1952. 41p. Contract N9-onr-87301.

11248 CRL-43
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE QUANTUM THEORY OF ANGULAR MOMENTUM. W. T. Sharp. July 1957. 84p. (AECL-465).

Notes for a nine lecture course are presented. Lectures on rotation matrices, Clebsch-Gordon coefficients, recoupling coefficients, tensor operators, multipole fields, tensor parameters and angular distribution, and principles of nuclear spectroscopy are included. (D.E.B.)

11249 K-1221
Oak Ridge Gaseous Diffusion Plant, Tenn.
EFFECT OF SURFACE MOBILITY ON GAS PHASE TRANSPORT THROUGH POROUS MEDIA. Edwin N. Lassettre. Feb. 12, 1957. 15p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A theoretical study was made of the effect of surface mobility on gas phase transport, at low pressures, through a porous medium. The medium considered is a bed of spheres all of the same radius. The results obtained are as follows. (1) Transport through the gas phase in a porous medium is affected significantly by the mobility of adsorbed gas molecules on the surface of particles of the medium even when the surface diffusion of molecules from one particle of the medium to another is omitted in calculating the transport. (2) The largest factor by which the permeability of a bed of spheres can be altered is 13/9 and the permeability increases with increase in surface mobility. (3) The effect of surface mobility on gas transport depends on particle size of the porous medium and is greatest at small particle sizes. Calculations for a glass medium suggest that the effect is potentially important at particle diameters of a few hundred angstroms although the magnitude of the effect depends critically on the surface diffusion coefficient and an absorption constant. Hence a particle size in the above range is not sufficient in itself to insure a significant effect unless the diffusion coefficient and extent of adsorption are also favorable. (auth)

11250 K-1316
Oak Ridge Gaseous Diffusion Plant, Tenn.
THE EFFECT OF A THIN FILM ON THE KNUDSEN FLOW OF GAS THROUGH A POROUS MEDIUM. W. H. Eberhardt and R. B. Bernstein. May 8, 1957. 12p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The effect of deposition of a uniform film of thickness t over all solid surfaces of the medium is examined. An expression for the function $p(\rho)$ is derived in terms of the corresponding function for the original medium. This function is used to calculate the ratio, R, of the permeability after the deposition of the film to that of the original medium. The results are specialized to two simple but reasonable analytical forms for $p(\rho)$ and provide analytic expressions for the ratio of permeability as a function of the ratio of the film thickness to the mean pore radius, t/r. The precise dependence of R on t/r is sensitive to the form assumed for $p(\rho)$ and may provide a means of distinguishing between different functions, or equivalently, between different geometries of a medium characterized by a given mean pore size. (auth)

11251 K-1342
Oak Ridge Gaseous Diffusion Plant, Tenn.
SOME PROPERTIES OF POROUS SOLIDS DEDUCED FROM APPARENT VOLUME MEASUREMENTS. H. B. Jenkins, Jr. Aug. 22, 1957. 26p. Contract W-7405-Eng-26. $0.75(OTS).

In theoretical studies of Knudsen flow through porous media it is customary to assume that the molecules follow straight-line paths between collisions with the walls of the flow system which themselves are idealized as geometrical surfaces. The drastic nature of this assumption is perhaps insufficiently appreciated, particularly as regards fine-pored media. Some relevant experimental data are analyzed which illustrate the fact that the geometrical picture is indeed an oversimplification. The approach is made through classical statistical mechanics. Data on the apparent volumes of various rare gases in equilibrium with different porous media are used. These data were obtained from previous experiments performed by Halsey and Steele. The experimental data of the apparent volumes of the gases as a function of absolute temperature are fitted by the method of least squares. From each of these analytical expressions the partition function of the atoms which are present in the porous medium is obtained. This partition function along with the partition function of the gas atoms in equilibrium with the porous medium is used to study the potential field, entropy change, and other properties of the atoms in the porous medium. (auth)

11252 KAPL-M-SMS-67
Knolls Atomic Power Lab., Schenectady, N. Y.
REPORT ON THE DECONTAMINATION OF KAPL 120 LOOP. F. C. Steiner. May 15, 1957. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The procedure and data obtained in the decontamination of KAPL-120 loop are summarized. A fill-and-flush procedure using the concentrated reducing decontamination solution was used to solubilize and remove the crud scale from the out-pile loop surfaces. Fuel elements had previously been removed from the pile tube and the latter was isolated from the external portion of the loop. The decontamination factor after a single $3\frac{1}{2}$ hour treatment of the loop followed by repeated water flushes ranged from 2 to 2.5 as measured by the dose rate at selected points of the loop. Samples of the decontamination solution and of the initial water flush indicate that about 100 g of crud (Fe_3O_4) was removed from the loop surfaces. Radiochemical analyses of the solution established that Co^{60} was the major constituent contributing to the gamma dose rate. Although an appreciable portion of the activity was retained on the special ion exchange column (as evidenced from a dose rate reading in excess of 2R/hr) it was observed that the Fe-EDTA complex (purple) was contained in the ion exchange effluent. Except for a leak at a thermocouple well to no equipment trouble was experienced after the decontamination test and a hydrostatic test at 2200 psi indicated no leaks. It appears that use of the fill-and-flush procedure is compatible with a stainless steel system and can be applied to portions of the S3G/S4G system. (auth)

11253 MURA-339
Midwestern Universities Research Assn., Madison, Wis.
THE PRODUCTION BY VOLUME CURRENT DISTRIBUTIONS OF MAGNETIC FIELDS, WHICH ARE REPRESENTED BY SPHERICAL HARMONICS IN A CURRENT FREE REGION, WHICH ENCLOSES PART OF THE MEDIAN PLANE. Edward S. Akeley. Aug. 1957. 32p. Contract AT(11-1)-384. $6.30(ph OTS); $3.00(mf OTS).

The scalar potential of a magnetic field is represented by a series of spherical harmonics in a current free region which encloses part of the median plane. The problem is treated of finding possible volume current distributions to produce this field, so that the field is everywhere zero outside a finite region that encloses the current distributions. (auth)

11254 NP-6352
Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.
QUARTERLY PROGRESS REPORT NO. 25. July 15, 1957. 61p. Contract N5ori-07856.

Investigations of the applicability of group theory to atomic energy bands and structures in crystalline fields are discussed. Studies of the KCl crystal were continued by computing its electronic charge density. The computed values are compared with experimental values obtained by Witte. Additional configuration interaction calculations on the ground state of the hydrogen molecule are reported. The Hartree-Fock wave functions for the systems $O^+(s^2p^3,S^0)$, $O(s^2p^4,{}^3P)$, and $O^-(s^2p^5, P^0)$ were determined and used to compute the energies of atomic and ionic oxygen states which appear in OH^- ground state calculations. Details of the calculation are given. Initial work on HF electronic wave functions is reviewed. Hartree-Fock solutions for F, F^-, and Ne are tabulated. (For preceding period see NP-6265.) (D.E.B.)

11255 NP-6359
European Organization for Nuclear Research, Geneva.
SECOND ANNUAL REPORT. 1956. 76p.

Progress in the construction of CERN facilities at Geneva is reported. Special attention is given to construction of the two accelerators, a proton synchrotron and a synchrocyclotron. (For preceding period see NP-6006.) (D.E.B.)

11256 NP-6404
Battelle Memorial Inst., Titanium Metallurgical Lab., Columbus, Ohio.
THE PRESENT STATUS OF GLASS-REINFORCED PLASTICS FOR HIGH-TEMPERATURE SERVICE. G. W. Gynn. July 29, 1957. 17p.

A brief summary is presented of the engineering properties of three representative glass-reinforced plastics fabricated into laminates from Style 181 glass cloth and polyester, phenolic, and silicone resins. Comparisons are made of the properties of the glass-reinforced plastics and Ti, Al, and stainless steel alloys. (L.T.W.)

11257 ORNL-2345
Oak Ridge National Lab., Tenn.
PARTICLE-SIZE DISTRIBUTION OF THORIUM OXIDE BY A CENTRIFUGAL SEDIMENTATION METHOD. O. Menis, H. P. House, and C. M. Boyd. Aug. 22, 1957. 36p. Contract W-7405-eng-26. $0.30(OTS).

A cumulative, centrifugal sedimentation method, which is applicable to the determination of the particle-size distribution of ThO_2 in the particle-size range of 0.1 to 2.0 μ in diameter, is described. This method circumvents the objectionable effects of convection currents and Brownian movement and the inconveniently long sedimentation periods incident to the application of gravitational sedimentation methods to particulate matter less than two μ in diameter. By selection of suitable operating conditions it is possible to accomplish sedimentation in small, cylindrical-shaped cells in 25 minutes or less. Under these selected conditions of sedimentation the particle-size distribution can be obtained from the cumulative sedimentation data by the application of either Oden's method of tangential intercepts or a function-plot method. Results by this centrifugal method correlate well with results obtained by different gravitational sedimentation methods for the portion of sample composed of particles greater than two microns in diameter. (auth)

11258 PB-121998
Library of Congress. Technical Information Div., Washington, D. C.
INFRARED: A BIBLIOGRAPHY. PART II. Mauree W. Ayton, Thomas J. Derby, Virginia H. Boteler, and Clement R. Brown. Mar. 1957. 156p. [Contracts] NAonr-13-47 and NAonr-185-54.

The bibliography includes references to unclassified reports and documents and to formerly restricted reports downgraded to unclassified issued from 1931 to 1952 on the subject, which have been found by a systematic search of the sources listed below. All material concerned with the scientific aspects of infrared radiation and its effects, and all technical applications, with the exception of its use in industrial heating and drying processes, have been included. The infrared portion of the electromagnetic spectrum has been taken as the range from 0.8 μ to over 100 μ. Material on heat transfer theory and processes, as such, has been excluded. (auth)

11259 UCRL-4917
California. Univ., Livermore. Radiation Lab.
DISSOCIATION OF H_2^+ BY PHOTONS. W. Linlor, C. F. Barnett, and R. Reinhardt. June 12, 1957. 21p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

A measurement was made of the dissociation of vibrationally-excited H_2^+ ions by photons having quantum energy in the vicinity of 4 ev. The calculated cross section from theory is 3×10^{-18} cm^2. The experimental result is 10^{-17} cm^2; a factor of 10 uncertainty is present because the photon intensity was unknown by that factor. (auth)

11260 USNRDL-TR-159
Naval Radiological Defense Lab., San Francisco.
NOMOGRAM FOR RADIOACTIVITY IN GROSS FISSION PRODUCT ANALYSES. M. H. Rowell and E. C. Freiling. May 22, 1957. 7p. Project NS-081-001.

A nomogram is presented which facilitates calculations involving the age and size of fission product samples and the fission yields, half lives, and residual activities of the individual fission product nuclides. Although all important fission products of half-life greater than 1 hr are conveniently indicated, the nomogram is applicable to many more. (auth)

11261 AEC-tr-2987
RECENT MEASUREMENTS OF THE LIFETIME OF EXCITED ATOMS. M. Ardenne. Translated from Zhur. Eksptl'. i Teoret. Fiz. 26, 362-6(1954). 9p.

A description of an experimental installation for measuring the lifetime of excited atoms is given. The lifetime for the excited atoms found for the line H_β stands in much closer agreement with the data obtained from classical mechanics than from those of quantum mechanics. (auth)

11262 AEC-tr-2989
THE PROPERTIES OF THE LIGHT HELIUM ISOTOPE He^3 AT LOW TEMPERATURES. [PART] II. R. A. Chentsov. Translated from Uspekhi Fiz. Nauk 55, 265-87 (1955). 29p.

The fundamental theories of pure liquid He^3 and solutions of He^3 in He^4 are reviewed. 193 references. (L.T.W.)

11263 AEC-tr-2991
INDUSTRIAL METHODS FOR THE PRODUCTION OF KRYPTON AND XENON AND THEIR APPLICATION. V. G. Fastovskii. Translated from Kislorod 4, 5-14(1947). 34p.

11264 SCL-T-143
ON THE PERMANENT POLARIZATION OF THE ELECTRET. (Über die permanente Polarisation des Elektretan, Chapters II-V). Gerhart Groetzinger and Hans Kretsch. Translated by Marcel I. Weinreich from Z. Physik 103, 341-9(1969). 11p.

A number of experiments were conducted using beeswax to determine the effects of temperature on polarization and depolarization. Measurements were made using tempera-

tures up to the melting point. The experimental apparatus and techniques are described. (D.E.B.)

11265 TT-660

PROPAGATION OF ELECTROMAGNETIC WAVES ALONG AN INFINITE SPIRAL CRACK. (Rasprostranenie Elektromagnitnykh voln vdol' Beskonechnoi Spiral'noi Shcheli). S. A. Vakin. Translated by G. Belkov from Doklady Akad. Nauk S.S.S.R. 84, 37-40(1952). 8p.

11266

SCATTERING OF HIGH-ENERGY POSITRONS AND ELECTRONS, AND LARGE ANGLE PAIR PRODUCTION, IN LEAD. R. C. Miller and C. S. Robinson (Univ. of Illinois, Urbana). Annals of Physics 2, 129-56(1957) Aug.

The absolute positron and electron fluxes from Pb targets irradiated by bremsstrahlung have been observed at angles between 21° and 74° and energies between 50 and 170 Mev. The fluxes from aluminum were observed at 29.2°, and shown to agree closely with theory when the (rather small) effects of finite nuclear size are accounted for. The positron to electron ratios of aluminum suggest a direction for improvements on the first Born approximation calculation of large angle pair production. By use of several target thicknesses the fluxes from Pb have been separated into (1) large angle pair production and (2) scattering of pair particles originally produced at 0°. The observed scattering of positrons and electrons is believed to be largely elastic, and on this assumption absolute scattering cross sections have been obtained. The pair flux and scattering cross sections vary much less rapidly with energy and angle for positrons than for electrons. The squared form factor for positron scattering also varies less rapidly than for electron scattering, indicating less nuclear screening for positrons than for electrons. A similar conclusion is reached for pair production. The Pb + / − ratios, when extended to low energy, are consistent with theoretical results. (auth)

11267

CALCULATION OF SCATTERING FROM A COMPLEX SQUARE WELL BY A VARIATIONAL METHOD. J. Sokoloff and M. Hammermesh (Argonne National Lab., Lemont, Ill.). Annals of Physics 2, 157-65(1957) Aug.

In the course of numerical calculations of scattering from a complex square well, it was found useful to obtain estimates of phase shifts by quick hand computation. This can be accomplished by a simple variational method. The phase shifts for all angular momenta can be obtained in closed form convenient for computation. (auth)

11268

THE CUMULATIVE YIELDS OF THE KRYPTON AND XENON ISOTOPES PRODUCED IN THE FAST NEUTRON FISSION OF Th^{232}. T. J. Kennett and H. G. Thode (McMaster Univ., Hamilton, Ontario). Can. J. Phys. 35, 969-79(1957) Aug.

The relative fission yields for mass chains ending in stable Kr and Xe isotopes have been measured for the fast neutron-induced fission of Th^{232}. Isotope dilution techniques were used to determine the Kr/Xe ratio to assist in obtaining the absolute fission yields for these mass chains. The absolute yields were determined by the use of two methods, both giving results which were in excellent agreement. The fine structure observed for the Th^{232} mass-yield curve is compared with that of heavier fissile nuclides. (auth)

11269

REMOTE VIEWING. F. S. Bloxam. Nuclear Eng. 2, 315-20(1957) Aug.

Work behind a biological shield necessitates direct viewing through windows with and without lenses, or through mirror systems, or with closed circuit TV. The windows would consist of a tank of $ZnBr_2$ solution or a heavy lead glass which can be obtained in blocks or plates of a limited size. It is possible to stabilize the glass against gradual obscurement by radiation. The characteristics of different glasses are reviewed. (Tr-auth)

11270

GLASS TECHNOLOGY IN THE NUCLEAR FIELD. Nuclear Eng. 2, 333-4(1957) Aug.

11271

NEW EXPERIMENTS ON THE SPECIFIC HEAT OF LIQUID ^{4}He BELOW 0.7°K. J. Wiebes, C. G. Niels-Hakkenberg, and H. C. Kramers (Kamerlingh Onnes Lab., Leiden, Nederland). Physica 23, 625-32(1957) July.

11272

TABLES OF LIGHT SCATTERING FUNCTIONS FOR SPHERICAL PARTICLES. William J. Pangonis, Wilfried Heller, and Arvid Jacobson. Detroit, Wayne State University Press, 1957. 122p.

Light scattering functions derived from the Mie-theory for α- and m-values pertinent to liquid dispersions of nonabsorbing colloidal and small microscopic spheres assuming the use of visible radiation are given. (M.H.R.)

ASTROPHYSICS

11273 CRL-41

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

STELLAR EVOLUTION, NUCLEAR ASTROPHYSICS, AND NUCLEOGENESIS. A. G. W. Cameron. June 1957. 71p. (AECL-454).

11274

THE KINETIC TEMPERATURE OF AN ATMOSPHERE SUPPORTED BY RADIATION. I. Alvin H. Davis (Univ. of California, Livermore). Astrophys. J. 125, 771-87(1957) May.

The anisotropy of the kinetic temperature of a tenuous atmosphere in an anisotropic radiation field has been investigated under the assumption that the interaction between matter and radiation is restricted to absorption and emission of a single resonance line and that interatomic collisions are of negligible importance. The problem was first treated by Milne, using the approach of the theory of Brownian motion. The method used here, which is similar to one used by Langevin, seems to be more straightforward in principle. The results obtained are in qualitative agreement with those of Milne, although some significant terms arise which did not turn up in the earlier work. Numerical calculations are presented to show the extent of the anisotropy and its variation with the frequency of the resonance line and with the character of the radiation field. Estimates are made of the conditions under which the theory might be expected to apply to an actual stellar atmosphere. (auth)

11275

NUCLEAR REACTIONS IN STARS. BUILDUP FROM HELIUM. E. E. Salpeter (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 107, 516-25(1957) July 15.

The rates are calculated for thermonuclear reactions involving alpha particles, at temperature T of the order of 10^8 °K. In particular, the conversion of three alpha particles into a C^{12} nucleus and (α,γ) reactions on C^{12}, O^{16}, and Ne^{20} are considered, as well as $C^{13}(\alpha,n)O^{16}$. Rough estimates are also given for alpha reactions on the other isotopes of N, O, F, and Ne. The reaction rates are used to re-evaluate some characteristic central temperatures T_c for Hoyle and Schwarzschild's model for the evolution of a population II red giant: for stars "at the tip of the red-giant branch," where helium burning first becomes important,

$T_c \approx 1.0 \times 10^8$ °K; for stars at the beginning of the "horizontal branch," where helium burning contributes appreciably to the energy production, $T_c \approx 1.3 \times 10^8$ °K. At these temperatures the rates of formation of C^{12}, O^{16}, and Ne^{20} are roughly comparable (if the spin and parity of a certain resonance level in Ne^{20} is suitable), but the production rate of Mg^{24} and heavier nuclei is negligible. Of the alpha reactions on the rarer isotopes, by far the fastest is $C^{13}(\alpha,n)$ and most of the C^{13} is used up near $T_c = 0.8 \times 10^8$ °K. (auth)

11276

RADIATION AGE OF A METEORITE FROM COSMIC-RAY-PRODUCED He^3 AND H^3. F. Begemann and J. Geiss (Univ. of Chicago, Ill.) and D. C. Hess (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 540-2(1957) July 15.

The H^3 and He^3 contents of the Norton County stone meteorite were measured. At the time of fall (1948) the tritium activity of two different specimens were (0.28 ± 0.02) and (0.25 ± 0.02) disintegrations min^{-1} g^{-1}. The measured He^3 contents per gram were (2.27 ± 0.11) and (2.35 ± 0.11) × 10^{-4} cc STP respectively. Experiments were made which indicate that there has been no appreciable loss of He^3. The amount of He^3 accumulated and the tritium production rate combined give apparent He^3-H^3 ages for irradiation of 420 and 480 million years respectively. If an assumption is made as to the direct production rate of He^3 by spallation, these ages reduce to 240 and 280 million years. The $A^{40}-K^{40}$ age of this meteorite is 4000^{+640}_{-740} million years. The possible significance of this difference in age is discussed. (auth)

11277

COSMIC RAYS NEAR THE NORTH GEOMAGNETIC POLE IN THE SUMMERS OF 1955 AND 1956. H. V. Neher (California Inst. of Tech., Pasadena). Phys. Rev. 107, 588-92(1957) July 15.

The experiments herein described are a continuation of similar experiments performed in previous years near the north geomagnetic pole. In 1954 low-energy particles were found at high altitudes which had the characteristics of protons with energies down to 150 Mev. In 1955 flights to higher altitudes (4 g cm^{-2}) indicated that these energies extended down to at least 100 Mev for protons. The numbers of both the high-energy particles (E>1 Bev) and those of low energy, in 1955 were less than in 1954. On one flight in 1955 the very low-energy particles were missing. In 1956, these low-energy particles (<300 Mev for protons) were missing completely. The shape of the ionization-depth curves at high altitudes appears to be a sensitive index of the presence or absence of these low-energy particles. In 1956 the shape of the curves at low pressures (<100 g cm^{-2}) was similar to those of 1951 when the low-energy radiation was missing and when a knee was present in the latitude curve at high altitudes. It is inferred that a knee was also present in 1956 but not in 1955. The fluctuations were also large in 1955 and 1956 compared with 1954. The average intensity of cosmic rays since 1954 has been decreasing with time as the sun approaches its maximum activity. This is in accordance with Forbush's relationship. However, in 1956 three of six flights showed intensities in the lower part of the atmosphere even less than any of the flights of 1937 at Saskatoon, Canada, in spite of the fact that the sun's activity in 1956 was less than in 1937. (auth)

COSMIC RADIATION

11278

THE ORIGIN OF COSMIC RAYS. V. L. Ginzburg. Uspekhi Fiz. Nauk 62, No. 2, 37-98(1957) June. (In Russian)

Report is given on the theory of cosmic ray origin based on radioastronomic data and other available experimental data. The theory of the solar and metagalactic origin of cosmic rays and the possible ways of accelerating the particles near stars are not included. The article is going to be published in English in the collection of the "Progress in Cosmic Ray Physics," edited by Wm. Wilson. (R.V.J.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

11279

THE CRYSTAL STRUCTURES OF THORIUM BISMUTHIDES. Riccardo Ferro (Genoa Univ., Italy). Acta Cryst. 10, 476-7 (1957) July.

11280

EFFECT OF LOW-TEMPERATURE PLASTIC DEFORMATION UPON THE OPTICAL PROPERTIES OF ALKALI HALIDES. G. Chiarotti (Univ. of Illinois, Urbana). Phys. Rev. 107, 381-7(1957) July 15.

The optical absorption spectrum of KBr and KI crystals, which have been plastically deformed at low temperature, has been observed in the region of the α band in order to detect single-ion vacancies generated by moving dislocations. As a result of the present experiment no α band has been observed in KBr and KI crystals plastically deformed at several temperatures between –180°C and –125°C. The number of α centers is estimated to be less than 10^{16} cm^{-3} for KBr or KI crystals after 5% of plastic strain. A general broadening of the fundamental absorption band takes place after plastic deformation. On the other hand, a yellow photoluminescence can be excited in the spectral region of the broadened fundamental absorption. A rough proportionality exists between the amount of luminescence and the number of photons absorbed in the region of the crystal responsible for the extra absorption. Annealing at room temperature reduces both luminescence and extra absorption. A qualitative explanation is given, which is based on the present knowledge of defects in alkali halides. (auth)

11281

ELECTRICAL PROPERTIES OF BORON SINGLE CRYSTALS. William C. Shaw, D. E. Hudson, and G. C. Danielson (Iowa State Coll., Ames). Phys. Rev. 107, 419-27(1957) July 15.

The electrical resistivity, Hall coefficient, and thermoelectric power of microscopic B single crystals have been measured as a function of temperature. Rectification and photoconductivity effects were observed at room temperature. The large majority of these single crystals had a high resistivity (about 1.7 × 10^6 ohm cm at 300°K) which decreased by a factor of nearly 10^{10} as the temperature was increased from 200 to 1000°K. A few crystals, however, had a much lower resistivity at 300°K (less than 100 ohm cm) and at this temperature their resistivity decreased much more slowly with increasing temperature. Such behavior is attributed to donor impurity levels. From data in the high-temperature range (800 to 1000°K) the energy gap between the filled band and conduction band was calculated to be 1.55 ± 0.05 ev. Hall, thermoelectric, and rectification studies indicated that hole conduction predominated for all crystals at high temperatures but that electron conduction predominated for the low-resistivity crystals near 300°K. The mobilities of the charge carriers at 300°K were found to be the order of one cm^2 $volt^{-1}$ sec^{-1} with the hole mobility the larger. Non-ohmic conduction was observed and shown to arise from Joule heating. (auth)

11282

DEFECTS IN CRYSTALLINE STRUCTURE AND PROPERTIES OF METALS AND ALLOYS. I. Ya. Dekhtyar.

Uspekhi Fiz. Nauk 62, No. 2, 99-128(1957) June. (In Russian)

Studies were made of various atomic defects in the crystalline lattice of metals (voids, dislocations) which formed during crystallization of liquid metals, cold and thermal treatments, or strong irradiation. Investigations of metal and alloy properties show that the same type defects effect diffusion, electroconductivity, plastic deformation, and other processes. (R.V.J.

ELECTRICAL DISCHARGE

11283 AECU-3498

Argonne National Lab., Lemont, Ill.

ELECTROMAGNETIC POSITION INDICATOR. Joseph N. Young. June 7, 1957. 3p. $1.80(ph OTS); $1.80(mf OTS).

An electromagnetic system was designed to indicate the axial position of a magnetic rod sealed inside a nonmagnetic stainless steel pipe. The position indicator consists of an a–c voltmeter across the coil and a 60 cycle, constant current power supply. The approximate position of the rod is indicated by a series of light bulbs and the precise indication is made by switching the meter to the coil in which the end of the rod is effective. Four variations of this indicator are outlined and a wiring diagram is included for a test model. (C.H.)

11284 AECU-3533

Sandia Corp., Albuquerque, N. Mex.

TIME-DEPENDENT, CYLINDRICAL, HYDROMAGNETIC FLOWS FOR MEDIA WITH SCALAR CONDUCTIVITY. O. G. Owens. June 11, 1957. 12p. Contract [AT(29-1)-789]. (TM-133-57-51). $3.30(ph OTS); $2.40(mf OTS).

The existence and uniqueness of one-dimensional, cylindrical, hydromagnetic sink-flows for isotropic media with constant electrical conductivity are established under the assumption that the magnetic permeability μ, the conductivity σ, the dielectric constant ϵ (all in mks units), and the radius r satisfy the inequality $\mu\sigma^2r^2 < 16\ \epsilon$. The investigation requires an analysis, using successive approximations, of a generalized one-dimensional, Euler-Poisson-Darboux equation. (auth)

11285 NYO-7897

Princeton Univ., N. J. Project Matterhorn.

WAVES IN A PLASMA IN A MAGNETIC FIELD. Ira B. Bernstein. Apr. 10, 1957. 44p. (PM-S-27). $0.35(OTS).

The small oscillations of a fully ionized plasma, in which collisions are negligible, in a constant external magnetic field, is treated by the Laplace transform method. The full set of Maxwell equations is employed and the ion dynamics are included. Various limiting cases are considered. It is shown that self-excitation of waves around thermal equilibrium is impossible. It is also demonstrated that for longitudinal electron oscillations propagating perpendicular to the constant magnetic field, there are gaps in the spectrum of allowed frequencies at multiples of the electron gyration frequency, but zero Landau damping. These particular waves are also associated with a nonuniformity of convergence in the limit of vanishing magnetic field. When the ion dynamics are included, two classes of low frequency oscillations are found, the existence of both of which has been predicted by the simple hydrodynamic theory, namely longitudinal ion waves, and transverse hydromagnetic waves. The results for the propagation of electromagnetic waves in an ionized atmosphere are also recovered, as well as the effects on such waves in various limiting cases of the magnetic field and particle motion. These calculations indicate that in many cases the transport equations are capable of yielding correct results, apart from such things as Landau damping, for a wide class of waves in a collision-free plasma. (auth)

11286 NYO-7898

Princeton Univ., N. J. Project Matterhorn.

EXACT NON-LINEAR PLASMA OSCILLATIONS. Ira B. Bernstein, John M. Greene, and Martin D. Kruskal. June 10, 1957. 22p. (PM-S-28). $0.25(OTS).

The problem of a one-dimensional stationary nonlinear electrostatic wave in a plasma free from interparticle collisions is solved exactly by elementary means. It is demonstrated that, by adding appropriate numbers of particles trapped in the potential energy troughs, essentially arbitrary travelling wave solutions can be constructed. When one passes to the limit of small amplitude waves it turns out that the distribution function does not possess an expansion whose first term is linear in the amplitude, as is conventionally assumed. This disparity is associated with the trapped particles. It is possible, however, to salvage the usual linearized theory by admitting singular distribution functions. These, of course, do not exhibit Landau damping, which is associated with the restriction to well behaved distribution functions. The possible existence of such waves in an actual plasma will depend on factors ignored in this paper, as in most previous works, namely interparticle collisions, and the stability of the solutions against various types of perturbations. (auth)

11287 UCRL-Trans-307(L)
UCRL-Trans-308(L)

INVESTIGATION OF THE GAS DISCHARGE OF A VERY STRONG CURRENT IN A LONGITUDINAL MAGNETIC FIELD. A. L. Bezbamchenko, I. N. Golovin, D. P. Ivanov, V. D. Kirillov, and N. A. Yavlinskii. Translated by Esther S. Goldberg from Atomnaya Energiya 1, 26-37(1956). 22p. (UCRL-307(L)) and ON THE STABILITY OF A CYLINDRICAL GAS CONDUCTOR IN A MAGNETIC FIELD. V. D. Shafranov. Translated by Esther S. Goldberg from Atomnaya Energiya 1, 38-41(1956). 7p. (UCRL-308(L)).

A gas discharge in deuterium with pinch current up to 700 ka and a longitudinal magnetic field up to 12,000 gauss was investigated. The influence of the field on the development of the discharge and the rise of the magnetic field inside the discharge column were determined. An estimate is given of the conductivity of the plasma and the conductivity of ionization. The criteria for the stability of an ideal gas conductor in an external magnetic field were found. (tr-auth)

11288

PRODUCTION OF HIGH-ENERGY PLASMAS BY MAGNETICALLY DRIVEN SHOCK WAVES. A. C. Kolb (U. S. Naval Research Lab., Washington). Phys. Rev. 107, 345-50(1957) July 15.

High-voltage discharges (5–100 kv) with peak currents in 0.3 to 5 μ sec have been used to produce shock waves in deuterium plasmas. The discharge is struck in a transverse magnetic field and the resultant Lorentz force drives the plasma out of the region of the discharge into a quartz side arm. Velocity measurements of the magnetically driven plasma are discussed in relation to the parameters of the discharge. These measurements indicate that deuterium plasma with ion energies >100 ev/ion at densities $> 5 \times 10^{16}$ ions/cm^3 can be produced by this method. (auth)

11289

RELAXATION OF A SYSTEM OF PARTICLES WITH COULOMB INTERACTIONS. W. M. Mac Donald (Univ. of Wisconsin, Madison), M. N. Rosenbluth (Univ. of California, Berkeley), and Wong Chuck (Univ. of California, Livermore). Phys. Rev. 107, 350-3(1957) July 15.

The relaxation to a Maxwellian distribution of a system of particles interacting through inverse-square-law forces is investigated in the approximation of two-particle interactions resulting in small-angle deflections of particle trajectories. The time required for the relaxation of the distribution in the neighborhood of the average energy is found to agree with the self-collision time defined by Spitzer. The time required for the distribution to become Maxwellian throughout the range from zero energy to several times the average energy is found to be nearly ten times the self-collision time. Filling of the high-energy portion of the Maxwell distribution is also discussed. (auth)

11290

CHARACTERISTIC ENERGY LOSS OF ELECTRONS PASSING THROUGH METAL FOILS. II. DISPERSION RELATION AND SHORT WAVELENGTH CUTOFF FOR PLASMA OSCILLATIONS. Richard A. Ferrell (Rand Corp., Santa Monica, Calif. and Univ. of Maryland, College Park). Phys. Rev. 107, 450-62(1957) July 15.

Previous work is extended so as to provide a determination of the shortest wavelength at which plasma oscillations can be sustained by a degenerate electron gas. The collective oscillations are treated without introducing collective coordinates, thereby avoiding possible complications associated with subsidiary conditions. Instead the Hartree self-consistent field method is used to provide a direct quantum-mechanical analog to the Bohm-Gross derivation of the dispersion relation. The effect of electron exchange, calculated by replacing the Hartree by the Hartree-Fock method, somewhat decreases the dependence of the plasma frequency on wave number. The maximum wave number corresponds to the momentum just sufficient to cause an electron at the surface of the Fermi sea to make a real transition, absorbing one plasma quantum of energy. This criterion agrees well with Watanabe's measurement of the maximum angle by which electrons undergoing the characteristic energy loss are scattered. The previous work on the intensity of the characteristic energy loss as a function of angle is supplemented by a study near cutoff, where it is shown that the intensity drops rapidly to zero as the maximum angle of scattering is approached. By use of the generalized sum rule of Nozières and Pines it is also possible to study the contribution of one-electron excitation to the differential stopping power. Varying as the fourth power of the angle of scattering, this contribution is negligible at small angles and first becomes dominant as the cutoff is approached. (auth)

ELECTRONS

11291

ELECTRON POLARIZATION IN BETA PROCESSES. R. B. Curtis and R. R. Lewis (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 107, 543-7(1957) July 15.

Recent experiments have confirmed the hypothesis of Lee and Yang that there exist terms in the beta interaction which destroy the invariance of the theory under space inversion and charge conjugation; the possibility of the lack of invariance under time reversal had not yet been tested conclusively. The further consequences of these additional interactions are explored limiting the discussion to experiments involving the detection of polarized electrons and gamma rays from unpolarized nuclei. In particular, formulas are derived for the longitudinal polarization of electrons in beta decay, and for the correlation of the transverse polarization of electrons with the direction of a gamma ray. Such experiments would lead to an independent verification of the violation of selection rules for parity and charge conjugation, and to a possible test of the invariance under time reversal. (auth)

GASES

11292 NP-6348

Purdue Univ., Lafayette, Ind.

DIFFUSION IN GAS MIXTURES TO 1,000 ATMOSPHERES. Technical Report No. I for March 15, 1957–June 15, 1957. C. O. Bennett and T. R. Mifflin. 44p. OOR Project No. ORDOR-AC-P-1537/A18637. Contract DA 33-008-Ord-1218.

The annular diffusion cell has been used for the measurement of the coefficient of self-diffusion in argon at 50°C and several pressures. The results indicate that it would be desirable to modify the design of the cell in order to improve the precision of the measurements. The operation of the two types of cells is described and included, as an appendix, is a paper discussing the relations in a binary mixture among the measured rates of diffusion using radioactive tracers and the ordinary diffusion coefficient. (auth)

11293 ORNL-2325

Oak Ridge National Lab., Tenn.

HELIUM-3 SYSTEM. B. J. Massey. Aug. 22, 1957. 5p. Contract W-7405-eng-26. $0.15(OTS).

The ORNL equipment and procedures for purifying, storing, and dispensing He^3 are described. (T.R.H.)

11294 AEC-tr-2761

THE USE OF PULSE DISCHARGES FOR SPECTRUM ANALYSIS OF GAS MIXTURES. O. P. Bochkova and E. Ia. Shreider. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 75(1955). 3p.

11295

GASEOUS AND SURFACE REACTIONS INVOLVING HELIUM METASTABLE ATOMS AND RESONANCE PHOTONS. R. F. Stebbings (Univ. Coll., London). Proc. Roy. Soc. (London) A241, 270-82(1957) Aug. 7.

The absolute electron yield (γ_M) for He (2^3S) metastable atoms incident on a gold surface has been measured. The method requires passage of a metastable atom flux through a collision chamber containing argon and thence to the gold surface. From observations on the current of argon ions arising from collisions of the type $He\ (2^3S) + A \rightarrow He + A^+ + e$, together with measurements of the electron emission from the gold surface, γ_M may be determined. The total cross sections for collisions between metastable helium atoms and He, Ne, A, and Kr have been measured and in the asymmetrical cases are observed to rise linearly with increasing atomic number of the target atom. Some collisions involving helium resonance radiation have also been studied. In particular, the photo-electric yield from the gold surface has been determined together with the attenuation of the photon flux in passage through certain noble gases. (auth)

INSTRUMENTS

11296 AECU-3535

Illinois. Univ., Urbana. Electrical Engineering Research Lab.

RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Quarterly Report No. 5 [for] March 1, 1957 to June 1, 1957. P. D. Coleman, M. D. Sirkis, R. Becker, R. Kenyon, R. H. Pantell, H. Spuhler, and A. W. Swago.

June 15, 1957. 67p. Contract AT(11-1)-392. $10.80 (ph OTS); $3.90(mf OTS).

Progress is reported in the following studies: the megavolt electronics approach to the generation problem; design and development of a practical, compact, portable relativistic electron accelerator and buncher called a rebatron; the electron injection problem; development of new accelerating cavity designs; the design and fabrication of a 10 cm rebatron; the origination of generation schemes using the million volt, bunched electron beam from the rebatron to produce high pulsed power in the 0.1 to 1 mm wavelength region of the electromagnetic spectrum; development of a beam harmonic higher order mode device for producing millimeter and submillimeter waves, called a harmodatron; development of a dielectric harmodatron designed to resonate at 0.982 mm; the development of a direct radiation dielectric coupling system using the Cherenkov effect; and the development of crystal multipliers for use as power sources for bench-testing other components and coupling devices in the millimeter wave range. (For preceding period see AECU-3460.) (C.H.)

11297 AECU-3537

Sandia Corp., Albuquerque, N. Mex.

A SINGLE-CYCLE LOOPING DEVICE FOR FERROELECTRIC CERAMICS. R. W. Kulterman. June 28, 1957. 30p. Contract AT(29-1)-789. (TM-179-57-51). $4.80 (ph OTS); $2.70(mf OTS).

A circuit is described which was built up to obtain electric displacement versus electric field curves (D vs E loops) of ferroelectric ceramics. The circuit is designed so that these loops can be obtained using a single cycle or several cycles of a 60-cycle/sec sine wave. Also described are some preliminary measurements made with the circuit on lead zirconate titanate. From these measurements, a curve-relating planar coupling factor to remanent polarization was obtained from a sample of lead zirconate titanate. (auth)

11298 AECU-3543

Sandia Corp., Albuquerque, N. Mex.

TRANSISTORS. COUNTERS. Neith Pollard. May 29, 1957. 22p. Contract AT(29-1)-789. (TM-119-57-14). $4.80(ph OTS); $2.70(mf OTS).

Two transistor plug-in decade counters are described, one of which operates over the SCS-7 temperature range. A transistor digital scanner with storage and parallel readout is described. It utilizes one of the plug-in decades. A simple design procedure for flip-flops is presented. (auth)

11299 HW-50610

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AUTOMATIC COBALT TESTER. K. Drumheller and C. E. Huck. June 6, 1957. 12p. [Contract W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The Co tester is used in the production operation for determining whether or not AlSi has leaked past the Al plugs into the center of cored fuel elements. It utilizes a Co^{60} γ source, which is collimated and directed axially through the center of the fuel element to a scintillation head. The pulses picked up by the scintillator are counted by a pre-set scaler to determine the amount of material through which the γ rays from the Co source have passed. A minimum count is determined by taking a standard count for several production fuel elements and a standard cored fuel element. The scaler is pre-set at this minimum value and any fuel elements which fall below this count are considered as possible rejects. Mechanization of this operation was achieved by installation of a device which automatically locates the fuel elements in line with the gamma source. A pre-set scaler-timer combination provides a reject signal when a minimum count is not exceeded in a fixed time interval. This installation has eliminated the need for one production operator at this station and has increased the capacity of the tester by 50%. (auth)

11300 NARF-57-34T

Convair, Fort Worth, Tex.

GATE-ON TIMER. C. M. Travis, B. A. Kelly, S. M. Hearne, and B. R. Baker. Aug. 15, 1957. 37p. Project 6-(1-9964), Task 1. Contract AF-33(600)32054. (MR-N-161).

Certain applications of the 256-channel pulse height analyzer require measuring the total input gate on time during a spectrum analysis for proper interpretation. Since computing this time mathematically is extremely tedious, it is desirable that a direct-reading method be devised. A system capable of reading this gate-on time directly was designed and built. This Gate-On Timer is capable of storing over $3\frac{1}{2}$ hours of total gate-on time and of indicating this time to within 0.1 sec. It also provides an accurate time measurement for the subtraction of background counts from a spectrum stored in the 256-channel analyzer memory, together with a means for automatically stopping the background subtraction after the proper elapsed gate-on time. The system consists of a single unit mounted on a 13- × 3- × 17 in. chassis having a $8\frac{3}{4}$- × 19-in. front panel. It weighs 27 pounds and consumes 196 watts of 115-volt 60-cps power. (auth)

11301 RIB-20

David Sarnoff Research Center, Princeton, N. J.

DEVELOPMENT OF HIGH SPEED ELECTRON ACCELERATOR STRUCTURES. Quarterly Report No. 2 [for] November 1, 1956–January 31, 1957. M. H. Greenblatt. R. M. Matheson, A. H. Sommer, and G. O. Fowler. Feb. 25, 1957. 28p. Contract AT(30-1)-1958. $4.80(ph OTS); $2.70(mf OTS).

Calculated transit times for the test model of central electrode multiplier structure are given. Two tubes with 6810 type structures were examined for collection efficiency and transit time dispersion. Work on the short-term approach to improve time resolution, reduction of electron path lengths, and secondary emission experiments was continued. Measurements indicate that transit time dispersion is 0.67×10^{-9} sec at 400 volts/stage for a 6-stage multiplier of the 931-A structure. The pulse-height distribution obtained with a 6810 multiplier using Co^{60} radiation with a NaI scintillating crystal and with special scintillating glass is shown. This glass produces light flashes about $\frac{1}{20}$ as large as those from NaI. (For preceding period see RIB-19.) (M.H.R.)

11302 RIB-23

David Sarnoff Research Center, Princeton, N. J.

DEVELOPMENT OF HIGH SPEED ELECTRON ACCELERATOR STRUCTURES. Quarterly Report No. 3 [for] February 1, 1957–April 30, 1957. M. H. Greenblatt, R. M. Matheson, A. H. Sommer, and G. O. Fowler. 38p. Contract AT(30-1)-1958. $6.30(ph OTS); $3.00(mf OTS).

Work on the central electrode multiplier structure was continued. An electron gun being developed for use in connection with time selection in fast multiplier structures is diagrammed. A design of an improved electron optical system for collecting the photoelectrons emitted from the cathode on the first dynode is diagrammed and its collection efficiency given. A brief analysis of the time dispersion to be expected from a photomultiplier is presented. An attempt is made to improve the time resolution of coincidence circuits by triggering the circuit at a specified

fraction of the total pulse amplitude. A source of a short duration light flash for performance tests of high speed photomultipliers is considered. Gain vs. primary voltage curves of Cs activated Ag–Mg and Cu–Be dynodes are included. Collection efficiencies and time dispersions for two 5-inch multiplier tubes are given. (For preceding period see RIB-20.) (M.H.R.)

11303 AEC-tr-2962

DIRECT LIGHT ELECTRON MICROSCOPE. G. Bartz, G. Weissenberg, and D. Wiskott. Translated from Radex Rundschau 4-5, 163-72(1956). 18p.

11304 AEC-tr-2963

DIRECT OBSERVATION OF METAL SURFACES BY MEANS OF ELECTRONS DISCHARGED BY IONS. G. Möllenstedt and M. Keller. Translated from Radex Rundschau, Nos. 4/5, 153-162(1956). 13p.

Pictures are presented of metal surfaces achieved with an emission microscope which released electrons from the specimens by means of ion bombardment (20 kv beam) at an angle. The design and performance of the electron microscope for direct viewing of the metal surface are described. (R.V.J.)

ISOTOPES

11305 AEC-tr-2966

THE PROPERTIES OF THE LIGHT ISOTOPE OF HELIUM He^3 AT LOW TEMPERATURES. [PART] I. R. A. Chentsov. Translated from Uspekhi Fiz. Nauk 55, 49-80 (1955). 33p.

The properties of the ordinary isotope of He at low temperatures are reviewed. The availability of He^3, methods of enrichment of He with the light isotope and of obtaining pure He^3, diagram of state of He^3 and properties of liquid He^3, and liquid solutions of He^3 and He^4 are discussed. (J.E.D.)

11306

THE THREE-BODY NUCLEAR INTERACTION IN K-40. S. P. Pandya and J. B. French (Univ. of Rochester, N. Y.). Annals of Physics 2, 166-75(1957) Aug.

An estimate of the effective three-body nuclear interaction between the nucleons outside closed subshells in K^{40} is made by comparing the low-lying energy levels of Cl^{38} and K^{40}. Use is made of the fact that, in jj coupling, and for an arbitrary two-body interaction, the $d_{\frac{3}{2}} \pm 1 f_{\frac{7}{2}}$ levels of one nucleus may be calculated from those of the other. After making a plausible calculation of the effects due to departures from the pure coupling scheme, we find a residual discrepancy between prediction and experiment which can be reasonably explained by invoking a repulsive three-body interaction. An argument, based on detailed features of the interconfiguration effects, suggests indeed that such a three-body interaction is required; if we assume this to be of short range, its magnitude is such that it contributes between 50 and 250 kev (for different J values) to the energy of the four outside nucleons in K^{40}. These magnitudes should, at least, define a reasonable upper limit to the allowable three-body interaction. (auth)

11307

THE BETA SPECTRUM OF CARRIER-FREE Ni^{63}. Ivor L. Preiss, R. W. Fink, and B. L. Robinson (Univ. of Arkansas, Fayetteville). J. Inorg. and Nuclear Chem. 4, 233-6(1957).

A method is given for the preparation of appreciable quantities of practically carrier-free Ni^{63} from pile irradiations of copper via the $Cu^{63}(n,p)$ reaction, which has an effective cross section of 3 millibarns for the neutron spectrum encountered in a typical LITR irradiation. The beta spectrum was studied in a large gas proportional counter with carrier-free Ni^{63} mounted on a saturation thickness of platinum foil placed as a platform inside the sensitive volume. The allowed Fermi-Kurie plot appears to be linear to 7.5 kev, which suggests that the decay probably belongs to the class of allowed transitions with exceptionally long half lives, interpreted to be "1-forbidden." The endpoint of the beta spectrum occurs at 67.0 ± 0.5 kev. The irradiation of spectroscopically-pure copper oxide powder produced appreciable amounts of Co^{60} and Zn^{65} corresponding to 0.6 ppm cobalt and 1 to 2 ppm zinc as subspectroscopic impurities in the target material. (auth)

11308

PRODUCTION OF CARRIER-FREE Mg^{28} FROM ALUMINIUM. J. Hudis (Brookhaven National Lab., Upton, N. Y.). J. Inorg and Nuclear Chem. 4, 237-8(1957).

Carrier-free Mg^{28} may be produced by the α,3p reaction in aluminum. The practical threshold for the reaction is ~35 Mev and the cross section with 41 Mev α particles is ~0.2 mb. (auth)

11309

THE ABSOLUTE YIELD OF Cs^{137} IN FAST-NEUTRON FISSION OF U^{235} AND Pu^{239}. P. Kafalas and C. E. Crouthamel (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 4, 239-44(1957).

The absolute fission yield of Cs^{137} has been determined for fast-neutron fission of U^{235} and Pu^{239}. The number of fissions was determined by absolute counting of the fission fragments. The Cs^{137} was determined by absolute β counting with an end-window proportional counter. The yields were found to be 6.87 and 7.45% for U^{235} and Pu^{239}, respectively. These values are based on a Cs^{137} half life of 32.6 years. (auth)

11310

ON THE HALF-LIFE OF O^{20}. R. Thieberger (Israel Atomic Energy Commission, Tel-Aviv). J. Inorg. and Nuclear Chem. 4, 367(1957).

It was determined that the probable half life of O^{20} is $3(^{+8}_{-2})$ min. (T.R.H.)

11311

AN EXPOSURE CALCULATOR FOR ISOTOPE RADIOGRAPHY. T. A. Cosh (British Steel Castings Research Association, Sheffield). J. Sci. Instr. 34, 329-32(1957) Aug.

The factors affecting exposure time in gamma radiography using Rn, Co^{60}, Ir^{192}, Tm^{170}, and Cs^{137} are correlated so that for any stated conditions the exposure time is rapidly determined. While primarily designed for the radiography of steel the use of thickness conversion scales enables the calculator to be used to determine the exposure time for other materials. (auth)

11312

DECAY OF SAMARIUM-153. M. C. Joshi, B. N. Subbarao, and B. V. Thosar (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. A45, 390-401(1957) June.

Radiations emitted in the decay of Sm^{153} have been studied in the Siegbahn-Slätis beta-ray spectrometer. Using the internal conversion electron spectrum and the photoelectron spectrum with tin as radiator, the internal conversion coefficient α_k has been determined for 120 kev and 70 kev gamma-rays. The relative intensities of the three beta-ray branches have been determined. A weak gamma-ray of energy 83 kev has been found and can be interpreted as a transition to the ground state from the first rotational level in Eu^{153}. The multipole order and character of the 102 kev transition is discussed. (auth)

MASS SPECTROGRAPHY

11313 AEC-tr-2974

A MASS SPECTROMETRIC ISOTOPIC ANALYSIS OF BORON TRIFLUORIDE. G. M. Panchenkov and V. D. Moiseev. Translated from Zhur. Fiz. Khim. 30, 1118-25 (1956). 13p.

The chief difficulty associated with the mass spectrometric determination of the isotopic composition of BF_3 lies in the strong adsorption of this gas in the mass spectrometer and the accompanying isotopic effect which arises during the desorption of it in the course of pumping. A technique for the measurement of the isotopic composition of BF_3, taking into account the peculiarities in the behavior of this gas was studied. This technique permitted the determination of the variation of the content of the isotope B^{10} in BF_3 with an accuracy exceeding 0.5% in the presence of a content of this isotope of about 20%. The content of the isotope B^{10} in a standard sample of BF_3 was measured. It was found that $q = 4.44 \pm 0.05$. (auth)

11314

THE IMAGE DEFECTS OF A DOUBLE FOCUSING MASS SPECTROMETER. H. Liebl and H. Ewald. Z. Naturforsch. 12a, 538-40(1957) July. (In German)

MATHEMATICS

11315 CF-57-7-23

Oak Ridge National Lab., Tenn.

NUCLEAR COMPUTATIONS FOR HRE-3 DESIGN: EQUILIBRIUM RESULTS. M. W. Rosenthal and T. B. Fowler. July 10, 1957. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS)$, 2.40(mf OTS).

Various nuclear characteristics of two-region spherical homogeneous reactors have been computed in order to provide information for the design of HRE-3. Equilibrium isotope concentrations were established using an ORACLE code, and a two-group model was used to obtain critical concentrations and flux distributions. Breeding ratio is plotted as a function of reactor size, blanket Th concentration, and other design and operating parameters, and the time required for a demonstration of breeding is discussed. Tables of results, including neutron balances, are given for selected reactors. A number of relations are presented for estimating the effects of fission products, Cu, corrosion products, H_2O, and the core tank on breeding ratio. (auth)

11316 NAA-SR-1972

Atomics International Div., Canoga Park, Calif.

THE DETERMINATION OF REACTOR TRANSFER FUNCTIONS FROM MEASUREMENTS AT STEADY OPERATION. M. N. Moore. Aug. 15, 1957. 16p. Contract AT-11-1-GEN-8. $0.20(OTS).

Upon application of the theory of stochastic processes to reactor kinetics it is possible to show that the square of the modulus of the reactor transfer function is proportional to the Fourier transform of the auto-correlation function for power noise in the reactor. Since the power noise represents the response to the minimum power input signal, measurements of transfer functions based upon reactor noise are of all possible measurements, least subject to non linear distortion. By performing the experiment at various power levels and temperatures, it is possible to measure both power and temperature coefficients. If the reactor is periodically monitored during its operation, long term changes can also be measured. (auth)

11317 NYO-7698

New York Univ., New York. Atomic Energy Commission Computing Facility.

THE ITERATIVE SOLUTION OF ELLIPTIC DIFFERENCE EQUATIONS. Bernard Friedman. June 1, 1957. 37p. Contract AT(30-1)-1480. $6.30(ph OTS); $3.00(mf OTS).

For a certain class of iteration schemes, it is proved that the method of successive point displacements converges twice as fast as the method of simultaneous point displacements. It is also proved that for such schemes the rate of convergence is unaltered by changes in order in which the iteration is done. (auth)

11318 R-256(RAND)

RAND Corp., Santa Monica, Calif.

A SURVEY OF THE MATHEMATICAL THEORY OF TIME-LAG, RETARDED CONTROL, AND HEREDITARY PROCESSES. Richard Bellman and John M. Danskin, Jr. Mar. 1, 1954. 112p. (AD-68786).

This report contains a summary of the mathematical techniques required to treat of physical phenomena involving time lags, retarded control, or hereditary effects. The functional equations which arise are no longer the differential equations of classical mathematical physics, but rather differential-difference equations, integrodifferential equations, and equations of even more complicated form. The most important applications of the mathematical theory arise in connection with control problems, and the resulting stability investigations. Questions involving these advanced methods arise in the theory of guided missiles and pilotless aircraft. It is here that the tremendous velocities, which are now feasible, make the time lags created by the control mechanism of great significance. In many cases it is impossible even to understand the origin of various instability phenomena without taking into account time lags and retarded control. For this reason these ideas are becoming of increasing importance in the field of servomechanisms and automatic control. Equations of this form also play an important role in mathematical economics where the analysis of interindustrial processes requires an awareness of the fact that some changes cannot occur instantaneously. Other physical phenomena requiring these concepts occur in the theory of magnetism, in the theory of elasticity and plasticity, and throughout the theory of fission processes. In the field of biology these ideas are required to explain mutation and, in general, the growth of unicellular organisms. They are of particular importance in furnishing an understanding of the effects of radioactive exposure, and thus, indirectly, in the study of cancer. In the field of psychology, they are necessary for any treatment of learning theory and other long-term effects, such as mental breakdowns. Problems of this type will occur wherever the future depends not only on the immediate present, but also on the past history of the system under consideration. (auth)

11319 UNM-TR-EE-3

New Mexico. Univ., Albuquerque. Engineering Experiment Station.

CONVERTING MEASURED ANTENNA PATTERNS TO SPHERICAL COORDINATES. John M. Usry and Robert B. Glascock. Mar. 1957. 18p. Project 56-12EE. [For Sandia Corp. Contract AT(29-1)-789.] $3.30(ph OTS); $2.40(mf OTS).

Two methods for developing the transformation from coordinates used in antenna measurements taken by the method of great circle cuts to a spherical coordinate system with the antenna at the origin are shown. Details of the method, and charts to aid in the transformation are given. (auth)

11320
STATISTICAL METHODS IN QUALITY CONTROL. Dudley J. Cowden. Englewood Cliffs, Prentice-Hall, Inc., 1957. 748p.

The first twelve chapters cover mainly statistical methods with illustrations from the field of quality control. The next sixteen chapters are devoted to process control, and the remaining ten chapters deal with product control. Mathematical derivations of some formulas are given. (W.L.H.)

MEASURING INSTRUMENTS AND TECHNIQUES

11321 AECU-3446
Argonne Cancer Research Hospital, Chicago.
DOSIMETRY OF KILOCURIE Co^{60} SOURCES. Lawrence T. Zimmer. Oct. 1956. 21p. Contract [AT(11-1)-222]. $4.80(ph OTS); $2.70(mf OTS).

In an effort to determine the γ-ray intensity from several Co^{60} sources, some primary and secondary dosimeters were constructed. Methods of calorimetry, ferrous sulfate oxidation, ionization chambers, and photographic film were studied and radiation intensity evaluated. Results from the absolute determinations were compared with those from a Victoreen condenser type meter calibrated by the National Bureau of Standards for Co^{60}, and the ionic yield of ferrous sulfate measured. Data are tabulated. (auth)

11322 AECU-3521
Levinthal Electronic Products, Inc., Redwood City, Calif.
CONVERSION EFFICIENCY OF SCINTILLATION PHOSPHORS. W. J. Van Sciver and L. Bogart. [1957?]. 8p. Contract [AT(04-3)-76]. $1.80(ph OTS); $1.80(mf OTS).

Conversion efficiencies (emitted useful light energy divided by exciting particle energy) have been reported for several scintillation phosphors. Variations in results (e.g. 1% to 10% for anthracene) indicate the desirability of a more reliable measuring procedure. A method which has given accurately repeatable results uses a calibrated thermopile and monochromator to measure photomultiplier cathode sensitivities and a light pulser tube and an electrometer to determine photoelectrons per scintillation pulse. In the latter step an RCA C-73687 light pulser tube is substituted for the phosphor in a typical scintillation counter setup. Its intensity is adjusted to give pulse height equivalent to that of the Cs^{137} photopeak. Finally the photomultiplier cathode current is measured with the electrometer. The current divided by pulse rate is photocathode electronic charge per pulse. Combination of this value with cathode efficiency and primary particle energy yields the phosphor's conversion efficiency. For a 1 in. × 1 in. Harshaw NaI(Tl) crystal with MgO smoked reflector and DC200 fluid optical coupling the value 13 ± 0.8% is obtained. (auth)

11323 AECU-3536
Levinthal Electronic Products, Inc., Redwood City, Calif.
SCINTILLATION AND OTHER RELATED PROPERTIES OF UNACTIVATED NaI CRYSTALS. Progress Report for the Period January 1, 1957–March 31, 1957. W. J. Van Sciver. May 8, 1957. 9p. Contract AT(03-3)-76. $1.80(ph OTS); $1.80(mf OTS).

The conversion efficiency of NaI(Tl) was determined, and the decay time of the 3000 A band in unactivated NaI was studied. (T.R.H.)

11324 AMRL-271
Army Medical Research Lab., Fort Knox, Ky.
BETA-EXCITED X-RAY SOURCES FOR LOW-ENERGY RANGE CALIBRATION IN SCINTILLATION SPECTROMETRY. G. R. Kraft, J. G. Kereiakes, O. E. Weir, and A. T. Krebs. Oct. 9, 1956. Project 6-59-08-014.

A technique for the calibration of the low-energy range (0 to 100 kev) in gamma scintillation spectrometry is presented. The method uses the characteristic x radiation produced in various target materials (either in metallic foil form or in free or compound salt form) by long-lived beta-emitting isotopes (as Sr^{90}-Y^{90} and Tl^{204}) for calibration purposes. (auth)

11325 CERN-57-29
European Organization for Nuclear Research, Geneva.
THE ANALYSIS OF NUCLEAR PARTICLE TRACKS BY DIGITAL COMPUTER. Y. Goldschmidt-Clermont. May 28, 1957. 31p.

11326 HW-39821(Rev. 1)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
TECHNICAL SPECIFICATIONS FOR GAMMA SCINTILLATION MONITORS. G. J. Alkire. Sept. 1956. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

11327 KAPL-1657
Knolls Atomic Power Lab., Schenectady, N. Y.
A TWO-HUNDRED-CHANNEL TIME ANALYZER FOR NEUTRON SPECTROMETRY. W. A. Bryant and M. L. Yeater. Mar. 8, 1957. 22p. Contract W-31-109-Eng-52. $0.25(OTS).

An electronic time analyzer for time-of-flight neutron spectrometry is described. It includes a system of thirty gated-coincidence circuits which are cycled under control of a pulsed oscillator to provide 200 time channels. Channel widths as short as 0.2 μsec can be obtained. The analyzer has been used with the KAPL neutron spectrometer, pulsed at a repetition frequency of 60 cps. It will record a maximum of one count per channel per pulse of primary neutrons, subject to the current limitation of the power supplies which energize the registers and to the short dead time (about 2 μsec) of the circuit which centers each recorded pulse within its time channel. (auth)

11328 NARF-57-15T
Convair, Fort Worth, Tex.
NTA INSTRUMENTATION SYSTEMS. Preliminary Report. R. R. Hayes and D. H. Rusling. June 10, 1957. 50p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-127).

The Nuclear Test Airplane (NTA), a B-36 modified to carry a reactor, is instrumented to measure fast-neutron dose rate, gamma dose rate, and thermal-neutron flux. The three basic instrument channels include a proton recoil fast-neutron dosimeter with binary pulse integrator; an anthracene scintillation dosimeter with electrometer for gamma radiation; and a BF_3 proportional counter with a pulse integrator for thermal neutrons. Most of the instrumentation is located in a capsule suspended in the forward bomb bay and controlled remotely from a panel in the crew compartment. Radiation detectors are located in the crew compartment and throughout the fuselage at fixed distances from the reactor. Each detector outside the crew compartment is mounted in a special, temperature-controlled housing. Experimental data are recorded on an analog-digital tape recorder designed to sample and digitize analog data and to accumulate pulse data over a preset time. Paper-strip chart recorders are used where continuous data-recording is required. Voice conversation is recorded on a magnetic tape recorder. Conventional transducers convert pressures, temperatures, and positions into recordable electrical signals. A modified closed-circuit television system enables the flight engineer to scan the airplane engines. (auth)

11329 NARF-57-31T

Convair, Fort Worth, Tex.

AIR SCATTERING OF GAMMA RADIATION FROM Co^{60}. J. R. Stokes and B. S. Burton. July 16, 1957. 20p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-156).

Air scattering of γ radiation from a Co^{60} source has been investigated experimentally. Measurements were made at 40 feet with a collimated γ spectrometer which allowed various regions of space to be examined for scattered radiation. The energy spectra were obtained to permit separation of the singly and multiply scattered components of radiation. Additional measurements are required to obtain a complete separation of these components. (auth)

11330 USNRDL-TR-154

Naval Radiological Defense Lab., San Francisco.

A TIME OF ARRIVAL DEVICE. K. F. Sinclair. May 14, 1957. 23p. Project NS 088-001.

The "Time of Arrival Detector" is primarily intended for field use as a fall-out detector. It is used to provide both elapsed time information and an electrical contact closure for timely initiation of other instrumentation. The unit is insensitive to long-term changes in ambient radiation conditions to a maximum of one roentgen, but an increase as small as 20 mr over a short period is sufficient to trigger the device. (auth)

11331 AEC-tr-2986

THE DIFFRACTION OF ELECTROMAGNETIC WAVES AT DIELECTRIC CYLINDERS AS A METHOD FOR MEASURING THE THICKNESS OF QUARTZ FIBRES. Ernest Eberhardt. Translated by E. L. Poole from Z. angew. Phys. 3, 242-6 (1951). 14p.

The stability and elastic properties of machine-made quartz fibers were determined by experimental measuring of their thickness using the diffraction of electromagnetic waves at dielectric cylinders. The experimentally obtained curves show the relationship between the diffraction appearance and diameter of the fiber. The correctness of the theory and the applicability of the method were checked by control measurements with an electron microscope. The range of measurements from 10 to 0.5 μ was with an accuracy of ~7%. (R.V.J.)

11332

SOME OBSERVATIONS ON THE BEHAVIOUR OF BROMINE QUENCHED GEIGER TUBES. R. E. Belin (Dominion Physical Lab., Lower Hutt, New Zealand). Australian J. Phys. 10, 263-7(1957) June.

A number of Geiger tubes were constructed using 18 : 8 low-carbon stainless steel and 99.9 + % Al cathodes with W anodes. Plateaux improved, but threshold voltages rose 2 v/°C with increase in temperature. Tubes with stainless steel cathodes operated at 100°C for one week showed no deterioration. A few tubes with Br pressures approximately 0.01 cm Hg in a total filling of 20 cm Hg argon exhibited oscillations over an interval along the length of the plateau. During this interval the tubes were insensitive to external radiations. These tubes, as well as others with higher Br pressures, also gave, at some defined overvoltage, Geiger pulses with extended tails, upon which 25 kc/s oscillations were superimposed. (auth)

11333

PERFORMANCE OF A BETA SCINTILLATION SPECTROMETER. SPECTRA AND CONVERSION COEFFICIENTS OF ^{137}Cs AND ^{207}Bi. R. A. Ricci. Physica 23, 693-703(1957) July.

The performance of a beta scintillation spectrometer (anthracene crystal) in nuclear spectroscopy has been investigated. A method of calibration of the spectrometer, its resolution and its response to different energies are reported. The nuclides Cs^{137}, Au^{198}, and Bi^{207}, which have well known conversion lines, were used for the calibration. The function $(\Delta E)^2/E$ was plotted against the energy and found to be linear in the energy region considered. The spectra of P^{32}, Co^{60}, Au^{198}, and Cs^{137} were analyzed. The total conversion coefficient of the 0.662-Mev gamma ray in the decay of Cs^{137} was computed and found to be 0.114 ± 0.022. The K conversion coefficients of the two stronger gamma rays in the decay of Bi^{207} were determined with the help of the measured gamma scintillation spectrum and found to be 0.019 (0.57 Mev transition) and 0.114 (1.06 Mev transition). (auth)

Refer also to abstract 11039.

MESONS

11334 NRL-4953

Naval Research Lab., Washington, D. C.

TABLES OF KINEMATICS OF Σ^+ HYPERON DECAYS. R. G. Glasser and G. A. Snow. May 7, 1957. 38p. Projects NR 540-000 and NR 54-005.

Tables were prepared of the transformations from the laboratory system to the rest system for the Σ^+ hyperon decays. The tables cover hyperon velocities (in units of the velocity of light) from 0.05 to 0.50 in intervals of 0.05. (auth)

11335 UCRL-3815

California. Univ., Berkeley. Radiation Lab.

THE ANALYSIS OF HYPERFRAGMENTS FROM STRANGE-PARTICLE INTERACTIONS (thesis). Fred W. Inman. June 21, 1957. 64p. Contract W-7405-eng-48. $10.80 (ph OTS); $3.90(mf OTS).

Hyperfragments containing bound Λ^0 hyperons are produced in strange-particle interactions. Hyperfragments that were produced by K^--meson and Σ^--hyperon interactions were studied. Approximately 3.2% of the K^--meson interactions led to hyperfragment production. Of 14 hyperfragments that decay mesonically, eight were analyzed completely and binding energies of the Λ^0 hyperons in the hyperfragments are as follows: ${}_\Lambda H^3$, −1.08 ± 0.72 Mev; ${}_\Lambda H^4$, 1.56 ± 0.65 Mev (2 events); ${}_\Lambda He^4$, 2.43 ± 0.64 Mev; ${}_\Lambda He^5$, 2.66 ± 0.39 Mev (2 events); ${}_\Lambda Li^8$, 5.56 ± 0.28 Mev (2 events); ${}_\Lambda Be^9$, 8.9 ± 2.3 Mev (nonmesonic). (auth)

11336

PHOTOPRODUCTION OF K MESONS FROM SINGLE NUCLEONS. Masaaki Kawaguchi (Purdue Univ., Lafayette, Ind.) and Michael J. Moravcski (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 107, 563-9(1957) July 15.

Perturbation calculations of the lowest order are carried out for K-meson photoproduction from single nucleons. Results are given for scalar and pseudoscalar mesons, with or without anomalous magnetic moments for the nucleons and hyperons, and with scalar, pseudoscalar, vector, and pseudovector couplings. Numerical results are given assuming unity for the coupling constant. The difference between the present results and those carried out for pion photoproduction is due to the mass difference of the nucleons and hyperons, the larger ratio of the meson mass to the nucleon mass, and the different values for the anomalous magnetic moments. The last of these effects is particularly striking and might be of pratical significance when sufficient experimental information is available. (auth)

11337

PHOTOPRODUCTION OF K MESONS IN HYDROGEN NEAR

THRESHOLD. A. Fujii and R. E. Marshak (Univ. of Rochester, N. Y.). Phys. Rev. 107, 570-2(1957) July 15.

The total cross sections near threshold of the three processes: $\gamma + p \rightarrow \Lambda^0 + K^+$, $\Sigma^0 + K^+$, $\Sigma^+ + K^0$, have been calculated as a function of the incident photon energy in the laboratory system under the assumptions that the hyperons have spin $\frac{1}{2}^+$ with positive anomalous magnetic moments and that the K meson has spin 0± and is coupled to the baryon field by direct Yukawa interaction. A pseudoscalar K meson gives a steep increase of the cross section for neutral production and at the same time gives a large K^0/K^+ production ratio compared to that for a scalar K meson. (auth)

11338

ISOTOPIC SPIN SELECTION RULE $|\Delta I| = 1/2$ FOR THE DECAYS OF STRANGE PARTICLES. Masaaki Kawaguchi (Purdue Univ., Lafayette, Ind.). Phys. Rev. 107 573-6 (1957) July 15.

Decay processes of strange particles are re-examined under the assumption of the selection rule $|\Delta I| = \frac{1}{2}$, when all particles concerned have isotopic spins, but parity is not necessarily conserved. Some of the results obtained before still hold as they are, even if parity nonconservation is taken into consideration. However, the relation between the branching ratio $(\Sigma^+ \rightarrow p + \pi^0)/(\Sigma^+ \rightarrow n + \pi^+)$ and the ratio of lifetimes $\tau(\Sigma^+)/\tau(\Sigma^+)$ is changed by parity nonconservation. The experimental results on Σ particles may be interpreted as indicating comparable magnitudes for parity-conserving and parity-nonconserving terms. Some results based on $|\Delta I| = \frac{1}{2}$ and $\frac{3}{2}$ are also discussed for these particles. (auth)

11339

PHOTOPRODUCTION OF NEUTRAL PIONS FROM HYDROGEN AT FORWARD ANGLES FROM 240 TO 480 Mev. W. S. McDonald and V. Z. Peterson (California Inst. of Tech., Pasadena) and D. R. Corson (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 107, 577-85(1957) July 15.

Recoil protons from the process $\gamma + p \rightarrow p + \pi^0$ have been detected by nuclear emulsions placed within a hydrogen-gas target and used to measure the differential cross section for production of neutral pions. In this manner protons of energies as low as 5 Mev can be detected at laboratory angles corresponding to emission of a pion at center-of-momentum (c.m.) angles as low as 26°. This experiment thus supplements that of Oakley and Walker which is in the same range of photon energies (240–480 Mev), but is restricted to pion c.m. angles greater than about 70° owing to higher minimum detectable proton energy. Common experimental points provide intercomparison of absolute values. Angular distributions are analyzed in the form $d\sigma/d\Omega = A + B\cos\theta + C\cos^2\theta$ in the c.m. system. The combined Oakley-Walker and present data give the average value of the ratio A/C as -1.60 ± 0.10 in the energy range from 260 to 450 Mev. The coefficient B, which gives the front-back asymmetry, passes through zero below the resonance energy of 320 Mev and is positive at higher energies. These results are consistent with magnetic dipole absorption leading to a state of the pion-nucleon system of angular momentum $\frac{3}{2}$, together with a finite amount of S-wave interference. (auth)

11340

CHARGE-EXCHANGE SCATTERING OF K^0 BEAMS AS A TEST OF THE PARITY-DOUBLET PROPOSALS. Henry P. Stapp (Univ. of California, Berkeley). Phys. Rev. 107, 585-7(1957) July 15.

The determination of the $K_{3\pi}$ to $K_{2\pi}$ ratio in K^+ beams obtained from the charge-exchange scattering of a beam of neutral K-particles should resolve the question of whether the K-particle is a parity doublet or a single particle. In the parity-doublet case the $K_{3\pi}$ to $K_{2\pi}$ ratio would, in general, depend upon the scattering angle and would differ from the value obtained in ordinary K^+ beams. The value of the ratio would depend upon, and give information concerning, the specific form of the interaction. If the K-particle is assumed to have zero spin, and if the strong interactions are charge-independent and are invariant under time reversal as well as space reflection and parity conjugation, then the $K_{3\pi}$ to $K_{2\pi}$ ratio in either the forward elastically scattered beam or in the backward elastically scattered beam must be four times its normal value. If there is a π–K interaction among these strong interactions, then it is the forward direction in which the $K_{3\pi}$ to $K_{2\pi}$ ratio is four times normal. (auth)

11341

MUON DECAY WITH PARITY NONCONSERVING INTERACTIONS AND RADIATIVE CORRECTIONS IN THE TWO-COMPONENT THEORY. Toichiro Kinoshita and Alberto Sirlin (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 107, 593-9(1957) July 15.

The decay of a polarized muon is studied in the case of the general four-component neutrino theory with the most general parity-nonconserving interaction. A three-parameter formula for the decay-electron distribution is obtained as a generalization of the Michel formula for an unpolarized muon. This general formula is examined to determine to what extent the observed spectrum enables one to decide whether any particular theory is correct or not. It is seen, among other things, that by the observation of the muon decay spectrum alone one cannot test the validity of the two-component neutrino theory. To facilitate a possible accurate experimental test of the two-component neutrino theory, the radiative correction for the decay of a polarized muon is worked out to the lowest order in α. Although the correction is rather complicated, it can still be expressed approximately by the three-parameter formula mentioned above. It is found, in particular, that the corrected Michel parameter for the two-component theory is 0.70_8 when a neutrino and an antineutrino are emitted in the final state, which is 6% smaller than the value 0.75 predicted by the simple theory. (auth)

11342

ANGULAR DISTRIBUTION OF POSITIVE PION PHOTOPRODUCTION FROM HYDROGEN. Michael J. Moravcsik (Brookhaven National Lab., Upton N. Y.). Phys. Rev. 107, 600-3(1957) July 15.

The analysis of all available data on the angular distribution of positive pions in photoproduction is carried out using a recently suggested method. The results are then compared with various theoretical predictions. It is shown that below resonance the various forms of the nonrelativistic theory give similar enough predictions so that present experiments could not distinguish among them. Above resonance the predictions diverge, and both the Low theory and the dispersional approach give surprisingly good agreement with data even at energies as high as 470 Mev. Below resonance the agreement with experimental data seems to be questionable, but more precise experiments are needed before definite conclusions can be drawn. It is also shown that the backward-to-forward ratio of the differential cross section is sensitive to the contribution of the $P_{\frac{3}{2}}$, electric quadrupole state, and thus this ratio might become a good way of exploring the degree of enhancement of the electric quadrupole contribution. (auth)

11343

PROPERTIES OF THE FIXED-SOURCE MESON THEORY. Katsumi Tanaka (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 616-20(1957) July 15.

The renormalized p-wave coupling constant is determined

from experiments in the following way. The ratio ρ_1 (ρ_2) of the matrix elements of the operator $\tau(\sigma\tau)$ between physical nucleon states and those between bare states is computed in terms of a renormalized p-wave coupling constant f^2 and a cutoff factor Ω, by solving a set of equations proposed by Ekstein. A sum rule in terms of ρ_1, ρ_2, f^2 and an integral over the phase shift δ_{33} is obtained from relations given by Cini and Fubini. Finally, by substituting ρ_1 and ρ_2 into the sum rule, we find f^2 in terms of Ω. The expectation values in the physical nucleon states, of the total number, total charge, and total energy of the mesons in the nucleon cloud and the self-energy of the physical nucleon are expressed as quotients of two power series in f^2. These quantities as functions of f^2 and Ω without making use of the experimental data. Comparison with the essentially experimentally determined values of Fubini and Thirring supports the idea that the Chew model is in agreement with low-energy experimental data. (auth)

11344

FORWARD-BACKWARD ASSMMETRY IN K-μ-e DECAY. W. G. Holladay (Vanderbilt Univ., Nashville, Tenn.). Phys. Rev. 107, 637-8(1957) July 15.

It is pointed out that, as a result of recent experiments relating to parity nonconservation, some important consequences of Sachs' classification of light fermions can be experimentally tested. (M.H.R.)

11345

RADIATIVE CORRECTIONS TO THE ASYMMETRY PARAMETER OF LOW-ENERGY POSITRONS IN MUON DECAY. Toichiro Kinoshita and Alberto Sirlin (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 107, 638-9(1957) July 15.

MICROWAVES

11346 OSR-TN-57-111

Technical Research Group, New York.

A TRAVELING WAVE GAS CELL MASER. M. Newstein and R. T. Daly. Feb. 27, 1957. 29p. Contract AF18(600)-1313. (AD-120464).

A proposed apparatus for the amplification of microwaves is described. Its particular advantage over conventional amplifiers is that it has a very low noise figure. It is a member of a class of instruments which amplify an incident radio frequency wave by causing this signal to pass through a substance in a non-equilibrium thermodynamic state and stimulate it into radiating coherently at the same frequency. (auth)

NEUTRONS

11347 AEC-tr-2988

DETERMINATION OF THE ABSOLUTE OUTPUT OF NEUTRON SOURCES. M. A. Bak, K. A. Petrzhak, and Yu. F. Romanov. Translated by V. Beak from Uspekhi Fiz. Nauk 58, 667-84(1956). 24p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-6932.

NUCLEAR PHYSICS

11348 BNL-433

Brookhaven National Lab., Upton, N. Y.

PROCEEDINGS OF THE BROOKHAVEN CONFERENCE ON RESONANCE ABSORPTION OF NEUTRONS IN NUCLEAR REACTORS, SEPTEMBER 24 TO 25, 1956. July 1957. 135p. $0.65(OTS).

11349 UCRL-3803

California. Univ., Berkeley. Radiation Lab.

NUCLEAR-STRUCTURE DEPENDENCE OF CONVERSION COEFFICIENTS IN ELECTRIC MULTIPOLE TRANSITIONS. Sven Gösta Nilsson. June 5, 1957. 33p. Contract W-7405-eng-48. $0.25(OTS).

The study of the effect of nuclear structure on internal conversion accompanying γ-transitions of electric multipole type which is presented is analogous to a treatment by Church and Weneser dealing with magnetic dipole transitions. The anomalous matrix elements found, corresponding to the situation when the electron penetrates the nucleus, are of the form expected classically. The magnitude of these anomalous terms for the E1 case seems unfortunately to be somewhat dependent on more detailed assumptions about the Coulomb field inside the nucleus. Only terms up to the second order in a perturbation expansion in the electromagnetic field are considered. In view of an occurring cancellation, discussed in some detail, this may not in all cases be a sufficiently accurate approximation. (auth)

11350

MIGDAL'S AND KHOKHLOV'S CALCULATIONS OF THE NUCLEAR PHOTOEFFECT. J. S. Levinger (Louisiana State Univ., Baton Rouge). Phys. Rev. 107, 554-8(1957) July 15.

Migdal's calculation of $\sigma_{-2} = \int \sigma W^{-2} dW$ is compared with experimental data on the nuclear photoeffect. The experimental data for seven nuclei from Al to U agree with the equation $\sigma_{-2} = 3.5A^{5/3}$ μb/Mev; while Migdal's calculation gives an equation of this form, but with a smaller coefficient. It is shown that Migdal's calculation gives a mean energy $(\sigma_{int}/\sigma_{-2})^{1/3}$ in essential agreement with Jensen's two-fluid model calculation of the resonance energy. Khokhlov's and Levinger's calculations of the bremsstrahlung-weighted cross section σ_b for a finite square well are compared with each other, and with experiment data, and agreement is found with the equation $\sigma_b = 0.30A^{4/3}$ mb. In the appendix a very simple calculation of the polarizability α of the deuteron is given with the result $\alpha = 0.64 \times 10^{-39}$ cm^3. (auth)

11351

ACCURACY OF THE BORN APPROXIMATION IN NUCLEAR MANY-BODY THEORY. D. J. Thouless (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 107, 559-62(1957) July 15.

Brueckner's equation for the reaction matrix in the many-body theory is solved for an S-state potential by an iterative process. The effective potential energy of a nucleon, and hence the binding energy, are calculated in the first order. When the second-order term is calculated, it is found that it is only a small correction which raises the binding energy from 16.9 Mev to 19.4 Mev per particle. No explanation of the saturation of nuclear forces at the known density can be given in this way. (auth)

11352

SPIN-ORBIT COUPLING AND TENSOR FORCES. B. Jancovici. Phys. Rev. 107, 631-2(1957) July 15.

Spin-orbit coupling in the shell model was investigated in the framework of Bruckner's theory. The couplings computed in this way are found to be an order of magnitude too small. (M.H.R.)

11353

MAGNETOHYDRODYNAMIC WAVES IN THE ATOMIC NUCLEUS. Hannes Alfvén (Royal Inst. of Tech., Stockholm, Sweden). Phys. Rev. 107, 632(1957) July 15.

11354

CHARGES AND PARITIES OF ELEMENTARY PARTICLES. D. W. Sciama (Trinity Coll., Cambridge, Eng.). Phys. Rev. 107, 632-3(1957) July 15.

A theory of elementary particles is outlined starting with the idea that particles with spin produce a gravitational field whose potential is a real nonsymmetric second-rank tensor. The consequences of this theory are given. (M.H.R.)

11355

SOME EXPERIMENTAL TESTS OF THE LÜDERS THEOREM. Henry P. Stapp (Univ. of California, Berkeley). Phys. Rev. 107, 634-5(1957) July 15.

11356

STATISTICAL THEORY FOR MULTIPLE FORMATION OF PARTICLES. S. Z. Belen'kii and V. M. Maksimenko, et al. Uspekhi Fiz. Nauk 62, No. 2, 1-36(1957) June. (In Russian)

The Fermi statistical theory for multiple processes was applied in studies of processes in the energy range 1 to 5 Bev. The interaction between particles, their isotopic spin, the identical charge distribution, the phase volume, and the secondary particle pulse distributions were analyzed. Comparisons were made of the experimental data for (n-n) and (π-n) collisions at 1 to 5 Bev and the tables of theoretical calculations of processes connected with antinucleon annihilation are presented. The method for finding the charge states in the statistical theory, the charge distribution, and isotopic invariability as well as the generator expression developed for the phase volume of arbitrary particle systems are included in the appendix. (R.V.J.)

NUCLEAR PROPERTIES

11357 AERE-NP/R-2104

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE HARWELL VALUES OF THE 2,200 m/sec NEUTRON DATA FOR U^{233}, U^{235} AND Pu^{239}. P. A. Egelstaff, ed. Mar. 18, 1957. 9p.

11358 JENER-Pub-13.

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

ON THE DETERMINATION OF NUCLEAR SPINS BY THE STUDY OF NEUTRON CAPTURE GAMMA RAYS. Georg Trumpy. 1957. 81p.

Two types of experiments, studying angular momenta of γ rays and of energy levels connected with radiative neutron capture, have been performed. Circular polarization of the γ rays emitted from nuclei capturing polarized neutrons was studied by means of the dependence of the Compton cross section upon the relative spin direction of the photon and the electron. Thermal neutrons polarized by transmission through magnetized iron fell on the (n,γ)-target, and the γ rays were detected by two NaI(Tl) crystals after having passed through analyzers of iron magnetized in the direction of transmission. The degree of circular polarization was found to be in accordance with theory. Measurements were performed for the most intense neutron capture γ rays from S, Ca, Ti, Cr, Fe, Ni, Cu, Zn, and W. Coincidence and angular correlation experiments were carried out using neutron capturing targets as sources. The existence of several γ-ray cascades was established. An earlier unobserved γ ray of 0.60 ± 0.05 Mev in Cu^{64} was found. The most prominent γ-ray cascades of Cl, Cr, Ni, and Cu were studied by the angular correlation method. Combined results of these experiments yielded several spin values for the nuclei studied. The first part of the paper deals with theoretical aspects pertinent to methods of these kinds. In particular, the degree of circular polarization of γ rays emitted from nuclei capturing polarized neutrons has been calculated for various cases, including emission of mixed multipoles. (auth)

11359 KAPL-1793

Knolls Atomic Power Lab., Schenectady, N. Y.

AN α49(E) CURVE CONSISTENT WITH EBR-1 MEASUREMENTS AND ALSO WITH MOST FORMER MEASUREMENTS. J. B. Sampson and D. F. Molino. May 16, 1957. 18p. Contract W-31-109-Eng-52. $0.20(OTS).

A critical review is made of experimental information concerning the energy dependence of the capture-to-fission ratio, α, of Pu^{239}. A form of this dependence is obtained which is shown to be consistent with nearly all measurements, including these recently reported for EBR-1. This dependence shows a rapid decrease with energy near 100 kev, and is intermediate in form between those of several previous suggestions. (auth)

11360 NARF-55-55T(Vol. II)

Convair, Fort Worth, Tex.

ACTIVATION HANDBOOK FOR AIRCRAFT DESIGNERS. VOLUME II. C. D. Dunn, D. B. Aydelott, and J. A. Staples. July 31, 1957. 36p. (FZK-9-089-2).

The information necessary for the calculation of activation γ dose rates from the individual radioisotopes of any material is provided. Data are included for 220 isotopic neutron reactions leading to the formation of radioisotopes. A comprehensive survey of the literature was made. (M.H.R.)

11361 UCRL-3770

California. Univ., Berkeley. Radiation Lab.

THE NUCLEAR SPINS, HYPERFINE STRUCTURE SEPARATIONS, AND MAGNETIC MOMENTS OF Cs^{127}, Cs^{129}, Cs^{130}, AND Cs^{132}. Howard Alan Shugart. May 15, 1957. 142p. Contract W-7405-eng-48. $21.30(ph OTS); $6.90 (mf OTS).

The nuclear spins, hyperfine structure separations, and magnetic moments of four Cs isotopes, Cs^{127}, Cs^{129}, Cs^{130}, Cs^{132}, have been measured, using an atomic beam magnetic resonance apparatus designed to utilize the low background flop-in method. The results are given. The spin measurement by Bellamy and Smith of $I = 5/2$ for (9.7 d) Cs^{131} has also been verified, using a different method of isotope preparation, detection, and identification. The isotopes Cs^{127}, Cs^{129} and Cs^{130} were prepared by (α,kn) reactions in I^{127}, while Cs^{129}, Cs^{131}, Cs^{132}, and other Cs isotopes were produced by (p,n) reactions in normal gaseous Xe. Detection of resonances of these radio-isotopes was accomplished by observing the activity deposited on S-coated buttons. Upon removal from the vacuum, the S collectors were counted in x-ray scintillation counters, employing 2 mm NaI, Tl-activated crystals and high gain photomultiplier tubes. In most cases the counters were set for the K x ray emitted following capture of the K electron by the nucleus. At these settings the low counter background (~ 1 count/min) permitted the observation of very low intensity resonances. The hyperfine structure separation of each isotope is obtained by observing the frequency of the associated resonance at progressively higher magnetic fields, where the frequency contains an appreciable quadratic shift. Using the Fermi-Segrè relation, the nuclear moment follows from the hyperfine structure measurement. The theory of the experiment, apparatus modifications, experimental procedure, and treatment of experimental data and results are described. (auth)

11362 UCRL-3855

California. Univ., Berkeley. Radiation Lab.

NUCLEAR INTERACTIONS OF ANTIPROTONS (thesis). Donald V. Keller. July 15, 1957. 75p. Contract W-7405-eng-48. $12.30(ph OTS); $4.50(mf OTS).

Attenuation and total annihilation cross sections were measured for 497-Mev antiprotons incident on H_2O, D_2O, O_2,

Be, Cu, Ag, and Pb. In addition, cross sections for positive protons were measured for all of the above materials under identical experimental conditions. The H_2O, D_2O, and O_2 results were subtracted to give the $\bar{p}p$, $\bar{p}n$, and $\bar{p}d$ attenuation and total annihilation cross sections. Within the 10% statistical accuracy of this experiment, and within the accuracy of a large correction due to the fact that in the deuteron the neutron is hidden partly by the proton, the $\bar{p}p$ and $\bar{p}n$ attenuation cross sections are the same, both being about 4 times larger than the pp cross section at the energy involved. The $\bar{p}p$ and $\bar{p}n$ total annihilation cross sections are also equal, within the experimental errors, and represent approximately 80% of the total attenuation cross sections. The poor-geometry cross sections for O_2, Cu, Ag, and Pb were extrapolated to zero solid angle to obtain the total inelastic cross sections. The ratio of the total inelastic cross section for antiprotons to that for protons seems to decrease as the atomic number Z increases (1.74 for O_2, 1.44 for Cu, 1.39 for Ag) indicating that the difference between the antiproton and proton cross sections on complex nuclei may be due to the interactions of the antiprotons with nucleons near the surface of the nucleus. The ratio of the annihilation cross section to the total inelastic cross section is approximately 0.75 for the four elements investigated and seems to increase with increasing Z. (auth)

11363 UCRL-3868

California. Univ., Berkeley. Radiation Lab.
SPIN AND HYPERFINE STRUCTURE MEASUREMENTS OF TWO NEUTRON-DEFICIENT GALLIUM ISOTOPES (thesis). John L. Worcester. July 15, 1957. 83p. Contract W-7405-eng-48. $2.25(OTS).

The spins of two neutron-deficient radioactive Ga isotopes have been measured by the atomic-beam resonance method. They are I = 0 for Ga^{68}, $T_{1/2}$ = 9.4 hr, and I = 3/2 for Ga^{67}, $T_{1/2}$ = 78 hr. The hyperfine structure constants, the magnetic dipole, and electric quadrupole moments of Ga^{67} in the $^2P_{1/2}$ electronic state are measured and results given. The direct transitions were not observed, but rather the hyperfine structures were determined by observing the transitions F = 3, $m_F = -1 \leftrightarrow -2$ and F = 2, $m_F = 0 \leftrightarrow -1$. The assignment of a positive sign to both the dipole and quadrupole moments is more consistent with the observed transition frequencies. (auth)

11364 AEC-tr-2960

ENERGY LEVELS OF THE NUCLEUS OF Li^6. (Urovni Yadra Li^6). Yu. L. Sokolov, et al. Translated from Doklady Akad. Nauk S.S.S.R. 111, 1219-22(1956). 8p.

Reactions of fast deuterons with Li^6 and Li^7 nuclei were investigated. Among the numerous reactions on the photoplates, the reactions $Li^6(d,2d)He^4$, $Li^6(d,d',p,n)He^4$, $Li^7(d,t,d')He^4$, and $Li^7(d,t,p,n)He^4$ were identified, and their energy levels analyzed. (R.V.J.)

11365 AEC-tr-2967

ON THE EXISTENCE IN NUCLEI WITH ODD A OF OCTUPOLE ISOMERIC TRANSITIONS WITH HALF-LIFE PERIODS OF $T_{1/2} = 10^{-4}$ TO 1 SECOND. V. I. Goldanskii and V. S. Evseev. Translated from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 20, 967-72(1956). 8p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 11-3533.

11366

THE STUDY OF ATOMIC NUCLEI WITH LOW AND MEDIUM ENERGY NEUTRONS. S. E. Darden (Univ. of Basle). Experientia 13, 261-74(1957).

In the case of light nuclei the experiments give information on the energy levels of the respective nuclei. The experiments on heavy nuclei permit the simplest method at hand for interpreting average neutron-nucleus interaction. (tr-auth)

11367

ELEMENTARY THEORY OF ANGULAR MOMENTUM. M. E. Rose. New York, John Wiley & Sons, Inc., 1957. 254p.

Basic principles are reviewed and a discussion of operators and their matrix representations is presented. The development is carried through the introduction of the coupling coefficients for vector addition (C-coefficients), the transformation properties of the angular momentum wave functions under rotations of the coordinate axes, irreducible tensors, and Racah coefficients. The applications presented deal with static moments of systems composed of charged particles and elementary magnetic dipoles, particles of intrinsic spin 1/2 and 1, oriented nuclei (this topic includes angular correlation in cascade disintegrations as well as angular distributions and changes in total cross sections in low-temperature experiments), coupling schemes in nuclear reactions, and wave functions for systems of identical particles. (M.H.R.)

11368

EXCITED STATES IN Co^{58} AND Fe^{56}. M. Mazari, A. Sperduto, and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 365-7(1957) July 15.

The energy-level scheme of Co^{58} has been investigated through studies of inelastic proton scattering. An electrostatic accelerator and a high-resolution magnetic spectrograph were used. The region of excitation studied ranged from the ground state to 3.6 Mev, and in this region forty excited states were found. A number of alpha-particle groups were observed to result from the proton bombardment of Co targets, and these were identified as arising from the $Co^{58}(p,\alpha)Fe^{56}$ reaction. The ground-state Q value for this reaction was measured as 3.242 ± 0.008 Mev. (auth)

11369

METASTABLE STATE OF Ge^{73}. E. C. Campbell and F. Nelson (Oak Ridge National Lab., Tenn.). Phys. Rev. 107, 502-3(1957) July 15.

A new short-period isomeric activity with a γ-ray energy of 54 kev and a half-life of 0.53 ± 0.03 sec has been observed following thermal neutron absorption in Ge^{72}. The γ-ray transition is shown to arise from a metastable state of Ge^{73} at 67.4-kev excitation energy, known from the decay of As^{73}, but not previously characterized as to half-life. Chemical separation of Ge^{73m} from As^{73} by a gas-sweeping technique was sufficiently rapid to allow decay measurements of the separated gas. The half-life so determined is within experimental error the same as that found in the neutron-produced activity. (auth)

11370

NEUTRON ACTIVATION CROSS SECTIONS WITH Sb–Be NEUTRONS. R. L. Macklin, N. H. Lazar, and W. S. Lyon (Oak Ridge National Lab., Tenn.). Phys. Rev. 107, 504-8 (1957) July 15.

The neutron activation cross sections near 25 kev have been measured for about 50 nuclei. Gamma-ray scintillation spectrometers with known efficiency were used to compare the radioactivities produced by the several nuclei with I^{128}. This gave a significant increase in sensitivity and precision over direct beta-counting methods in many cases. Absolute standardization was obtained through scintillation-beta-counting the I^{128} in NaI(Tl) crystals irradiated with a neutron source calibrated by the manganese bath technique. (auth)

11371

NEUTRON TOTAL CROSS SECTION OF Np^{237} FROM 0.02 to

2.8 ev. M. S. Smith, R. R. Smith, E. G. Joki, and J. E. Evans (Phillips Petroleum Co., Idaho Falls). Phys. Rev. 107, 525-7(1957) July 15.

The total neutron cross section of Np^{237} has been measured in the energy region 0.02 to 2.8 ev with the Materials Testing Reactor crystal spectrometer. Measurements were made on a sample containing 152 mg of Np^{237} in oxide form dissolved in deuterated HNO_3. A value for the absorption cross section at 0.025 ev of 170 ± 22 b was obtained. Resonances were observed at energies 0.489 ± 0.002, 1.337 ± 0.015, and 1.488 ± 0.018 ev, with the respective values of $\sigma_0\Gamma$ being 84.2 ev b, approximately 29 ev b, and approximately 140 ev b. Values for σ_0 of 2600 ± 100 b, Γ of 0.032 ± 0.003 ev, and $g\Gamma_n$ of 0.016 mv were determined for the 0.489-ev resonance. (auth)

11372

NEUTRINO MAGNETIC MOMENT UPPER LIMIT. Clyde L. Cowan, Jr., and Frederick Reines (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 528-30(1957) July 15.

A giant liquid scintillation detector was employed in a fission-reactor neutrino flux to set an upper limit of 10^{-9} Bohr magneton for the neutrino magnetic moment. The experiment consisted in searching for a count-rate difference associated with the reactor neutrinos. (auth)

11373

BETA SPECTRUM OF Bi^{212} (ThC). J. Burde and B. Rozner (Hebrew Univ., Jerusalem, Israel). Phys. Rev. 107, 531-6 (1957) July 15.

The beta spectrum of Bi^{212} was measured by using a short magnetic-lens beta spectrometer. Pb^{212} in equilibrium with its decay products was used as a source. The spectrum of Bi^{212} was separated from the other component spectra by measuring the coincidences between the beta spectrum and the alpha particles from Po^{212} (the nucleus formed after the beta decay of Bi^{212}) emitted with the half-life of 3×10^{-7} sec. One obtains a complex spectrum whose maximum energy is 2.27 Mev. The beta components were separated by Fermi plots. The end points for the component spectra and their relative intensities were found. Spins and parity assignments for the excited levels of Po^{212} were made. (auth)

11374

GYROMAGNETIC RATIO OF THE 10^{-8}-sec STATE OF Ta^{181}. V. E. Krohn and S. Raboy (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 536-7(1957) July 15.

The gyromagnetic ratio of the 482-kev state of Ta^{181} (10^{-8}-sec) has been measured by angular correlation techniques and found to be + 1.23 ± 0.05 nuclear units. (auth)

11375

DIFFERENTIAL CROSS SECTIONS FOR THE $C^{13}(He^3,p)N^{15}$ REACTION. E. Geer Illsley, H. D. Holmgren, R. L. Johnston, and E. A. Wolicki (U. S. Naval Research Lab., Washington). Phys. Rev. 107, 538-9(1957) July 15.

The differential cross sections for the $C^{13}(He^3, p)N^{15}$ reaction leaving N^{15} in the ground state have been measured at 17 angles for bombarding energies of 2.0 and 4.5 Mev and at 6 angles in 0.2-Mev intervals from 1.8 to 3.8 Mev. The angular distributions are generally peaked in the forward and backward directions and change relatively slowly with bombarding energy. The angular distributions at 2.0 and 4.5 Mev have been fitted with Legendre polynomial expansions by using the method of least squares. The data indicate a weak resonance at a bombarding energy of about 3.6 Mev. (auth)

11376

MEASUREMENTS OF PROTON STRENGTH FUNCTIONS. J. P. Schiffer and L. L. Lee, Jr. (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 640-1(1957) July 15.

Measurements of the S-wave proton strength functions were extended using a different technique and a maximum at A = 75 was found. (M.H.R.)

11377

RADIATIVE CAPTURE OF PROTONS IN CARBON FROM 80 TO 126 kev. W. A. S. Lamb and Ross E. Hester (Univ. of California, Livermore). Phys. Rev. 107, 550-3(1957) July 15.

An excitation curve has been measured for the reaction $C^{12}(p,\gamma)N^{13}$ in the energy interval 80 kev to 126 kev by utilizing beam currents of 30 ma to 50 ma from the high-current ion injector. The capture-gamma radiation was measured with a 4-in. × 4-in. NaI scintillator which was arranged to count only gamma radiation of the energy appropriate to the reaction. The yield per incident proton ranges from $(7.0 \pm 2.3) \times 10^{-18}$ at 80 kev to $(6.2 \pm 0.2) \times 10^{-16}$ at 126 kev with corresponding cross sections of $(1.4 \pm 0.4) \times 10^{-11}$ b and $(6.8 \pm 0.8) \times 10^{-10}$ b. A value for the cross section of the reaction $C^{13}(P,\gamma)N^{14}$ has been obtained at two energies, namely: $(8.2 \pm 2.5 \times 10^{-9}$ b at 126 kev, and $(5.1 \pm 2.5) \times 10^{-9}$ b at 114 kev. The results are compared with previous measurements and with extrapolations from the resonance in this reaction at 456 kev by means of the Breit-Wigner single-level dispersion formula. (auth)

11378

ELECTRON PAIR-PRODUCTION CROSS SECTIONS AT 2.5 Bev. John M. Brabant, Robert W. Kenney, and Roger W. Wallace (Univ. of California, Berkeley). Phys. Rev. 107, 604-6(1957) July 15.

A lead-glass photon spectrometer has been used to measure the total attenuation cross section of Pb and Al for photons of energy 2.5 ± 0.5 Bev produced in the Berkeley Bevatron. The electron pair-production cross sections have been inferred from the measured total cross sections. Preliminary data indicate that the electron pair-production cross section is 34.6 ± 6.6 b in Pb and 1.22 ± 0.17 b in Al. (auth)

11379

SPIN OF 27-HOUR ARSENIC 76. R. L. Christensen, H. G. Bennewitz, D. R. Hamilton, J. B. Reynolds, and H. H. Stroke (Princeton Univ., N. J.). Phys. Rev. 107, 633-4 (1957) July 15.

The Princeton focusing atomic beam was used to measure the angular momentum of the odd-odd nucleus As^{76}. The result I = 2 was found confirming previous results. (M.H.R.)

11380

QUADRUPOLE MOMENT OF O^{17}. M. J. Stevenson and C. H. Townes (Columbia Univ., New York). Phys. Rev. 107, 635-7(1957) July 15.

The quadrupole hyperfine structure due to the O^{17} nucleus was measured in the $2_{20} \leftarrow 2_{21}$, rotational transition of HDO by conventional techniques of microwave spectroscopy, and the value $(-0.026 \pm 0.009) \times 10^{-24}$ cm^2 calculated for the quadrupole moment of O^{17}. (M.H.R.)

11381

NUCLEAR QUADRUPOLE MOMENT RATIO OF Re^{185} AND Re^{187}. S. L. Segel and R. G. Barnes (Iowa State Coll., Ames). Phys. Rev. 107, 638(1957) July 15.

The pure nuclear quadrupole resonance spectrum of the natural isotopes Re^{185} and Re^{187} was detected in rhenium pentacarbonyl, $Re_2(CO)_{10}$. Two resonances were observed for each isotope, corresponding to the $\pm \frac{5}{2} \longleftrightarrow \pm \frac{3}{2}$ and $\pm \frac{3}{2} \longleftrightarrow \pm \frac{1}{2}$ transitions for spin $I = \frac{5}{2}$. The observed frequencies are listed. (M.H.R.)

11382

MEASUREMENTS OF THE PROTON STRENGTH FUNCTION. J. P. Schiffer and L. L. Lee, Jr. (Argonne National Lab., Lemont, Ill.). and R. H. Davis and F. W. Prosser, Jr.

(Rice Inst., Houston, Texas). Phys. Rev. 107, 547-9(1957) July 15.

The thick-target yield of gamma rays from the (p,p'γ) reaction has been used to calculate values of the strength function $(\gamma^2)_{Av}/\overline{D}$, of states in the compound nucleus for the channel of s-wave inelastic protons. Measurements of inelastic scattering to the 2+ first excited states of nine even-even nuclides, ranging from Ca^{44} to Zn^{64}, indicate a constant value for $(\gamma^2)_{Av}/\overline{D}$ of 2.7×10^{-14} cm, within experimental error. This may be compared with the resonance in neutron strength function near atomic weight 55 as found in neutron elastic scattering. (auth)

11383

PROTON-WIDTH STRENGTH FUNCTION. B. Margolis (Columbia Univ., New York) and V. F. Weisskopf (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 641(1957) July 15.

The calculated proton-width strength functions predict maxima at $A_p = 68$ and $A_p = 230$. (M.H.R.)

11384

ELECTRON-NEUTRINO ANGULAR CORRELATION IN THE POSITRON DECAY OF ARGON 35. W. B. Herrmannsfeldt, D. R. Maxson, P. Stahelin, and J. S. Allen (Univ. of Illinois, Urbana). Phys. Rev. 107, 641-3(1957) July 15.

11385

PARITY AND ELECTRON POLARIZATION: MØLLER SCATTERING. H. Frauenfelder, A. O. Hanson, N. Levine, A. Rossi, and G. DePasquali (Univ. of Illinois, Urbana). Phys. Rev. 107, 643-4(1957) July 15.

11386

FAST NEUTRON CAPTURE BELOW 1 MeV: THE CROSS SECTIONS FOR ^{238}U AND ^{232}Th. A. M. Lane and J. E. Lynn (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) A70, 557-70(1957) Aug.

Recent measurements of neutron capture in U^{238} and Th^{232} with neutron energies up to 1 Mev reveal anomalies in the capture cross sections. An attempt was made to fit these cross sections in terms of conventional compound nucleus theory, using the existing low energy resonance data to provide numerical values of the widths and other parameters. If one assumes some definite dependence of level density on energy, there are no free parameters left in the fitting. The level density formula of Lang and Le Couteur was used, and good absolute fits with the observed capture cross sections found. It emerges in the fitting that the anomalies are a consequence of the small rate of increase of the number of inelastic scattering channels with energy. This small rate is a result of the rotational nature of the low-lying spectra of U^{238} and Th^{232}. (auth)

11387

THE FISSION CROSS SECTIONS OF ^{233}U, ^{235}U, ^{238}U AND ^{239}Pu FOR NEUTRONS IN THE ENERGY RANGE 0.030 MeV TO 3.0 MeV. W. D. Allen and A. T. G. Ferguson (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) A70, 573-85(1957) Aug.

The fission cross sections of U^{233}, U^{235}, U^{238}, and Pu^{239} have been measured as a function of neutron energy for neutrons in the energy range 0.030 Mev to 3.0 Mev. In addition, measurements of the ratios of the fission cross sections as a function of neutron energy have been made. The fission cross sections and the ratios have been shown to be consistent and a set of best values of the cross sections has been computed. The accuracy over most of the range is to about 3%, falling to 5% at the extremes. (auth)

11388

HYPERFINE STRUCTURE COUPLING CONSTANT OF THE $6s6p\ ^3P_1$ LEVEL OF ^{199}Hg BY DOUBLE RESONANCE. G. S. Bogle, J. N. Dodd, and W. L. McLean (Univ. of Otago, New Zealand). Proc. Phys. Soc. (London) B70, 796-800 (1957) Aug.

A double resonance experiment on natural Hg is described. The value of the hyperfine structure coupling constant of the $6s6p^3P_1$ level of Hg^{199} obtained is 0.497 ± 0.014 cm^{-1}. (auth)

NUCLEAR REACTORS

11389 AECU-3427(Add.)

Internuclear Co., Inc., Clayton, Mo.

PRELIMINARY INVESTIGATIONS FOR AN ADVANCED ENGINEERING TEST REACTOR. C. F. Leyse and B. H. Leonard, Jr. Apr. 16, 1957. 14p. Contract AT(11-1)-500. (INTERNUC-9(Add.)).

A general description is given for the test reactor unit, the tentative data, and the neutron flux distributions. (R.V.J.)

11390 AECU-3526

Argonne National Lab., Lemont, Ill.

OPERATING MANUAL FOR THE CP-5 REACTOR. Jan. 1, 1956. 29p. Contract [W-31-109-eng-38]. $6.30 (ph OTS); $3.00(mf OTS).

To assure safe and reliable operation of the CP-5 Argonne Research Reactor, certain test procedures, work area checks, routine inspections, and operational practices have been established as the rules governing the operation of this reactor. These rules are set forth. (auth)

11391 AERE-H/PhC-41

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A BASIC STUDY OF FISSION PRODUCT POISONING. P. A. Egelstaff, E. Glueckauf, and J. E. Sanders. Mar. 1956. 14p.

The need for more complete and more accurate fission product data limits the prediction of the high-burnup reactivity behavior of reactors. The problems associated with fission product separation and measurement of their cross sections are reviewed, and a program is suggested for meeting the demands of further reactor development. (D.E.B.)

11392 ANL-5726

Argonne National Lab., Lemont, Ill.

FREQUENCY RESPONSE MEASUREMENTS OF THE EBWR AUTOMATIC STEAM BY-PASS VALVE CONTROL SYSTEM. J. A. DeShong, Jr. and E. S. Beckjord. June 1957. 18p. Contract W-31-109-eng-38. $0.20(OTS).

The EBWR steam by-pass system is designed to permit reactor operation at full power while varying the turbine-generator output from no load to rated power by diverting excess steam to the condenser. System performance was checked prior to reactor power experiments by means of frequency response measurements which were made to ensure that operation was smooth over the entire flow range and that response times were adequate. A brief description is given of a pressure signal generator which was developed to perform several of the measurements. (auth)

11393 ANL-5729

Argonne National Lab., Lemont, Ill.

TWO-GROUP DIFFUSION THEORY FOR A RING OF CYLINDRICAL RODS. R. Avery. June 1957. 21p. Contract W-31-109-eng-38. $0.20(OTS).

The conditions for criticality and the resulting flux distribution have been obtained in the two-group diffusion theory approximation for a ring of N equally spaced, identical cylindrical rods embedded symmetrically in a

radially bare cylinder. The system is uniform axially and of either finite or infinite height. Either or both of the two media of the system may be multiplying. The method used is a generalization of the Nordheim-Scalettar method for the solution of the control rod problem of similar geometry. In satisfying each of the various boundary conditions use is made of the Bessel function addition theorems to center all terms in the general solution at the appropriate line of symmetry The results are obtained in terms of a Fourier expansion of the angular dependence of the flux about each rod, which in application must be cut off after some early term in the infinite series. The order of the critical determinant is equal to twice the number of angular terms retained. (auth)

11394 BNL-3050
Brookhaven National Lab., Upton, N. Y.
THE NUCLEAR REACTOR AS AN INSTRUMENT OF MEDICAL RESEARCH AND THERAPY. E. E. Stickley, J. S. Robertson, and L. E. Farr. [Jan. 9, 1957]. 13p. $3.30(ph OTS); $2.40(mf OTS).

This paper describes reactor equipment and procedures employed in medical experimentation, with specific examples of the use of radioactive materials and instantaneous induced radiations. Limitations met in six years' experience with the research reactor are also listed. Utilization of facilities of the new Medical Research Reactor is outlined. (auth)

11395 BNL-3343
Brookhaven National Lab., Upton, N. Y.
THERMAL PROBLEMS IN THE LMFR. PART I. TEMPERATURE DISTRIBUTION IN A CORE CELL. J. Juliens. Sept. 28, 1956. 17p. $3.30(ph OTS); $2.40(mf OTS).

A mathematical study of temperatures in the LMFR was made to determine maximum power and channel dimensions. The results indicated no thermal problems in the proposed channels and suggest that channel dimensions may be considerably increased. (D.E.B.)

11396 BNL-3343-A
Brookhaven National Lab., Upton, N. Y.
THERMAL PROBLEMS IN THE LMFR. PART II. TEMPERATURE IN THE REFLECTOR. J. Juliens. Dec. 7, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

11397 CF-54-8-239
Oak Ridge School of Reactor Technology, Tenn.
ULTIMATE HOMOGENEOUS REACTOR. Reactor Design and Feasibility Problem. R. A. Thomas, J. F. Brunings, L. S. Hall, C. Michelson, J. F. Parrette, L. R. Pletke, R. L. Whitelaw, and W. A. Wittkopf. Aug. 1954. Decl. Apr. 9, 1957. 227p. $1.25(OTS).

The two phases of the work done by the ORSORT group are presented. The first phase of selecting the reactor type for the Ultimate Homogeneous Reactor is discussed. The second phase of the work is presented as a preliminary design of a 200-Mw two-region breeder reactor. Uranyl sulfate solution was selected for the UHR core fluid which is used to generate turbine steam. A boiling D_2O-ThO_2 slurry was used for the blanket. The D_2O blanket steam superheats and reheats the turbine steam. Pertinent features of the UHR are: higher core power density; higher thermal efficiency; and constant turbine steam conditions from no load to full load. (auth)

11398 CF-57-7-25
Oak Ridge National Lab., Tenn.
RADIATION LEVEL IN THE STATOR REGION OF THE HRT FUEL CIRCULATING PUMP. J. R. Engel. July 3, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The γ dose rate in the motor region of the HRT fuel circulating pump was measured with the pump scroll full of radioactive solution. Extrapolation of the data to the solution activity expected in the pump under normal operation gives a dose rate well below that which would result in excessive gas production in the stator can within the life of the pump. The above dose rate does not include the effects of fast neutrons from the fuel solution or of the general cell radiation level in the vicinity of the pump. It appears that the possibility of gas production in the stator from the cell background radiation is sufficiently great to warrant the installation of a shield around the outside of the motor end of the fuel circulating pump. (auth)

11399 CF-57-7-83
Oak Ridge National Lab., Tenn.
TREATMENTS FOR THE HRT CLOSED COOLING WATER AND COOLING TOWER WATER SYSTEMS. H. A. McLain. July 20, 1957. 5p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

Potassium chromate is recommended as the corrosion inhibitor for the HRT closed cooling water system. A combination of sodium chromate and sodium phosphate (Betz dianodic treatment) is recommended for the HRT cooling tower water system corrosion inhibitor. Algae growth in the cooling tower may be controlled by the periodic addition of chlorinated phenols to the cooling tower water. (auth)

11400 CF-57-8-53
Oak Ridge National Lab., Tenn.
PROPOSED HRT EXPERIMENTAL PROGRAM FROM INITIAL CRITICAL EXPERIMENT TO SUSTAINED POWER OPERATION. P. N. Haubenreich. Aug. 6, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

11401 CF-57-8-67
Oak Ridge National Lab., Tenn.
MODIFIED HRT REFRIGERATION SYSTEM. R. C. Robertson and H. A. McLain. Aug. 6, 1957. 39p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The primary refrigeration system of the HRT will be revised to include a 25-hp two-stage Freon-22 condensing unit and a new shell and tube-type evaporator to give a conservatively estimated capacity of 79,000 Btu/hr (with $-40°$F evaporating and 90°F condensing temperature) and a factory-rated capacity under the same conditions of 86,000 Btu/hr. The refrigeration controls system is being revised to give panel indication of the cold traps that are being refrigerated. (W.L.H.)

11402 CF-57-8-84
Oak Ridge National Lab., Tenn.
FLUX PEAKING IN HOMOGENEOUS REACTORS. C. W. Nestor, Jr. Aug. 21, 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Four types of D_2O-moderated homogeneous thermal reactors have been studied with the aid of a two-group, multi-region ORACLE code. The basic reactors were spherical with D_2O in the central region, U^{233} and D_2O in an annulus and a D_2O outer reflector. Three modifications of this basic type were calculated; the first modification had one-half inch thick Zr shells around the fuel-containing region and a six-inch thick iron pressure vessel outside the outer D_2O reflector; type III had a small spherical region containing highly concentrated fuel and poison in addition to D_2O inserted at the center; and type IV split this small sphere into a central sphere containing poison and an annulus containing fuel. The critical fuel concentrations, available thermal fluxes and power densities for reactors of types II through IV for a range of sizes, central fuel concentrations and poison levels are presented, and a

short discussion of the method of calculation and the ORACLE code is given. In general, little (~1.3) flux peaking is available in the central D_2O sphere, but relatively large (~10^{15}) thermal fluxes are available even in highly concentrated fuel (~100 grams/liter) for a thermal power of 100 megawatts. Power densities are high, however, averaging about 180 kw/l at the inner wall of the outer fuel annulus. (auth)

11403 CISE-56

Centro Informazioni Studi Esperienze, Milan.

BIBLIOGRAFIA INTRODUTTIVA SUI REATTORI AND ACQUA BOLLENTE. (Introductory Bibliography for Boiling Water Reactors.) A. Ricci. Apr. 9, 1957. 8p.

11404 CRC-696

Atomic Energy of Canada, Ltd. Chalk River Project, Chalk River, Ont.

A CALORIMETRIC DETERMINATION OF ENERGY DEPOSITION IN THE J-ROD ANNULUS OF THE NRX REACTOR. P. J. Dyne and W. Thurston. Apr. 1957. 32p. (AECL-432). $1.00(AECL).

The energy deposition in the J-rod annulus (graphite reflector) of the NRX reactor for samples of graphite, H_2O, D_2O, and Al has been directly determined by a calorimetric method. The energy deposition as a function of height is approximately a sine curve, the position of the maximum falling at the mid point of the D_2O height. The values for the energy deposition at the maximum are: graphite 19.7 ± 0.5 mw/g, H_2O 37.8 ± 1.4 mw/g., D_2O 27.3 ± 1.4 mw/g and Al 29.2 ± 0.7 mw/g when the reactor is running at 40 mw. The total energy deposition is the sum of three components, γ-ray heating, fast neutron moderation, and particles arising from nuclei activated by slow neutron capture. It is shown that the values for total energy deposition are consistent with the predicted fast neutron flux and neutron scattering and absorption cross sections and γ-ray absorption coefficients of these materials. (auth)

11405 CRL-44

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE DEVELOPMENT OF NRX AS A RESEARCH REACTOR. D. G. Hurst. Aug. 1957. 13p. (AECL-473).

The NRX Reactor is described, and its operation and control are discussed. Its usefulness in many types of research is pointed out. (T.R.H.)

11406 CRR-622(Rev.)

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

NRX ROD NO. 683. ANALYSIS OF IRRADIATED URANIUM AND ESTIMATION OF EFFECTIVE CROSS-SECTIONS. D. G. Hurst, A. H. Booth, M. Lounsbury, and G. C. Hanna. Jan. 1956. Revised May 1957. 72p. (AECL-447).

NRX rod 683 was irradiated to a burnup equivalent to 3100 Mwd/t. It was then removed from the reactor for use in a study of long irradiations. The rod was sectioned and specimens from various sections were analyzed for Pu and fission product distribution, U^{235} burnup, reactivity changes, and metallurgical effects. The procedures used in the analyses and their results are given. (D.E.B.)

11407 DP-232

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

POWER REACTOR STUDIES QUARTERLY PROGRESS REPORT [FOR] FEBRUARY, MARCH, AND APRIL 1957. July 1957. 33p. Contract AT[07-2]-1. $0.25(OTS).

Design concepts are given for a power reactor moderated with D_2O and fueled with natural U that will produce 100 Mw of electrical power. The basic physics and engineering problems for such a reactor are discussed, and estimates of fuel costs are given. (auth)

11408 HW-50339 A2

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TECHNICAL ACTIVITIES REACTOR DEVELOPMENT MONTHLY REPORT [FOR] MAY 1957. 4000 PROGRAM. June 10, 1957. 13p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40(mf OTS).

Fuel element alloy and oxide preparation and testing are briefly reviewed. Of primary interest is the development of Pu containing elements for the PRRE. (For preceding period see HW-49752 A.) (D.E.B.)

11409 HW-50675

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AUTO-RINSE CYCLE FOR FUEL ELEMENT RECOVERY. Completion Report. E. N. Wells. June 10, 1957. 12p. [Contract W-31-109-Eng-52]. $3.30(ph OTS); $2.40 (mf OTS).

A rinse system has been designed to provide for rinsing the fuel elements, after they have been removed from the treater tank, in an enclosed, vented tank, and recovering the U from the rinse water. After each load of fuel elements has been placed in the rinse tank, the rinse cycle is automatically timed and controlled. (auth)

11410 HW-51234 A2

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLUTONIUM RECYCLE PROGRAM MONTHLY REPORT, JUNE 1957. F. W. Albaugh, V. R. Cooper, and P. F. Gast. July 10, 1957. 11p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40(mf OTS).

Progress is reported briefly in development of fuel elements, materials instrumentation, and mechanical equipment for the PRPR. (T.R.H.)

11411 IDO-16318

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

AN ENGINEERING DESCRIPTION OF THE SPERT-I REACTOR FACILITY. T. R. Wilson. June 14, 1957. 43p. Contract AT(10-1)-205. $0.30(OTS).

An engineering description is presented of the SPERT-I Reactor Facility. The SPERT-I Reactor is the first of several reactors to be built for the purpose of conducting reactor transient behavior and safety studies on heterogeneous, light-water-moderated, enriched-fuel reactor systems. The reactor consists of an open vessel into which has been placed initially a plate type, U-Al core with no provision for heat removal or coolant circulation. The reactor is remotely operated from a Control Center approximately ½ mile from the reactor. Reactor excursions are brought about by the rapid addition of reactivity to the reactor, and the resulting kinetic behavior of the reactor observed. (auth)

11412 IDO-16343

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CALCULATED SURFACE TEMPERATURES FOR NUCLEAR SYSTEMS AND ANALYSIS OF THEIR UNCERTAINTIES. The First Report of the Heat Transfer Subcommittee of the Phillips Reactor Safeguard Committee. R. J. Nertney, ed. June 1, 1957. 62p. Contract AT(10-1)-205. $0.45(OTS).

A general discussion of the hot-channel and hot-spot factors, a discussion of practical considerations in deriving and applying these factors, and certain numerical examples

are presented. Nomograms are included which permit rapid solution of three of the important forced convection heat transfer correlation equations. A comparison of the calculated values of the heat transfer coefficient over a wide range of bulk and film temperatures for non-boiling water cooled systems is made for five of the more common correlation equations. A modification of the Colburn equation is recommended for general use. Quantitative discussions of the methods used and errors to be expected in determining flux values in the MTR and ETR by direct cobalt measurements are included as well as a quantitative discussion of the errors encountered in utilizing industrial instrumentation to determine the system parameters used in performing the heat transfer analyses. (auth)

11413 IGR-R/R-208

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

FLUX CHANGES IN A THERMAL REACTOR UNDER LONG-TERM IRRADIATION. A. J. M. Hitchcock, V. E. Price, and J. Shenton. June 1957. 120p.

A method has been developed which enables the neutron flux and reactivity changes in long-term irradiation of a thermal reactor to be calculated. The method has been programmed for a digital computor, and two trial cases have been solved. From these results it may be tentatively concluded that the maximum permissible power level, and the power ratings of a given channel may suffer long-term variations over a range of 30% or more of their initial values. (auth)

11414 JENER-47

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

ABSOLUTE NEUTRON AND GAMMA-RAY SPECTRA OF JEEP MEASURED BY MEANS OF NUCLEAR EMULSIONS. S. Selim-Younis. Apr. 1957. 21p.

Nuclear emulsions have been irradiated at the opening of the central channel (5/11) of JEEP. Calculations from 2000 recoil- and 100 deuteron photoproton-measured tracks showed that the total fast neutron flux at the opening is (2.2 ± 0.4) neutrons per cm^2 sec. watt. The energy distribution of the emitted neutrons shows a degradation from the thermal fission neutrons. The total flux of gamma rays, with energies greater than 2.5 Mev, is (40 ± 30) photons per cm^2 sec. watt. The absolute spectrum, neglecting the line structure, decreases exponentially with the energy and probably contains more hard rays around 8 Mev than the expected fission gamma rays. The approximated fit to the spectrum is given. (auth)

11415 KAPL-1642

Knolls Atomic Power Lab., Schenectady, N. Y.

TWO-SPACE-DIMENSION MULTIGROUP ANALYSIS OF A MOVING-FUEL REACTOR. (Second Edition). E. L. Wachspress. Apr. 30, 1955. 60p. Contract W-31-109-Eng-52. $0.45(OTS).

An analysis of both a three-cylinder and an eight-cylinder high-pressure water-moderated moving-fuel reactor has been completed. Results are presented with regard to fuel loading, reactivity, flux distributions, Xe effects, temperature coefficients, and other nuclear parameters. The nuclear feasibility of any particular reactor is dependent upon the design specifications. A casualty condition control requirement led to the need for a minimum of eight control cylinders. Three cylinders were adequate when the casualty condition was not considered. (auth)

11416 KAPL-M-AGR-1

Knolls Atomic Power Lab., Schenectady, N. Y.

NEGATIVE REACTIVITY EFFECT OF FUEL ELEMENT EXPANSION ON COLD STARTUP ACCIDENT. A. G. Reynolds. May 17, 1957. 25p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The purpose of this study is to determine the relative effect of the expansion of the fuel element on the power excursion of a pressurized water reactor during a startup accident. It is assumed that the control rods are withdrawn at a constant rate of 8¢/sec from a subcritical to a supercritical condition. When the rods are withdrawn the power will begin to increase and it is assumed that the only thing that limits the power excursion is the heating of the water and the expansion of the fuel element. The method of approach is to use the reactor kinetics equations to determine the heat generated in the fuel element and then use the node concept to determine the temperature of fuel, clad and water as a function of time. The results are in the form of plots; % power, fuel temperature, clad temperature, water temperature and reactivity versus time. (auth)

11417 KAPL-M-BES-2

Knolls Atomic Power Lab., Schenectady, N. Y.

A SURVEY EXPERIMENT IN REACTOR PULSING TECHNIQUES. B. E. Simmons. Jan. 9, 1957. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Bursts of neutrons were injected into the FPR, a polyethylene moderated highly enriched critical assembly, and the flux time decay rate following each burst was measured. Decay rates varied over a large reactivity range (including critical) roughly as predicted by simple two velocity group theory. Results were interpreted to give a neutron generation time of 36 μsec for the reactor, FPR-3. Present results represent only a preliminary survey of the technique. (auth)

11418 KAPL-M-MAA-1

Knolls Atomic Power Lab., Schenectady, N. Y.

BOUT AND BOUT II; THREE-GROUP BURNOUT CODES FOR USE WITH PROD II. O. A. Sappington, M. K. McRae, V. A. Walbran, and E. J. Brooks. May 28, 1957. 28p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

A three-group burnout program available for use with PROD II on the IBM 650 is described. Reactor models considered are restricted to those containing a single burnable poison and a single fuel. (auth)

11419 KAPL-M-WON-3

Knolls Atomic Power Lab., Schenectady, N. Y.

RESULTS OF ACCEPTANCE TESTS FOR BORON STEEL RODS. W. A. Neisz. Apr. 12, 1957. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A brief outline of the quality control and process used in the manufacture of boron steel rods is presented. (auth)

11420 LAMS-1611(Del.)

Los Alamos Scientific Lab., N. Mex.

LOS ALAMOS POWER REACTOR EXPERIMENT AND ITS ASSOCIATED HAZARDS. L. D. P. King, comp. Dec. 2, 1953. Decl. with deletions Jan. 10, 1957. 122p. Contract W-7405-eng-36. $19.80(ph OTS); $6.30(mf OTS).

Initial design criteria for the Los Alamos Power Reactor Experiment are set forth in considerable detail. The reactor is a high-pressure, high-temperature, homogeneous critical assembly intended primarily for the study of power production. An evaluation of the reactor hazards and several appendices containing information on criticality studies and heat generation by γ radiation are given. (M.H.R.)

11421 MIT-5007

Massachusetts Inst. of Tech., Cambridge.

FINAL HAZARDS SUMMARY REPORT TO THE AD-

VISORY COMMITTEE ON REACTOR SAFEGUARDS ON A RESEARCH REACTOR FOR THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY. Theos J. Thompson, Manson Benedict, Thomas Cantwell, and Roy A. Axford. Jan. 1956. 161p.

The location and final design of the heavy-water cooled and moderated heterogeneous MIT Research Reactor are described. An analysis of hazards from the reactor is presented. (C.H.)

11422 NAA-SR-1920

Atomics International Div., North American Aviation Inc., Canoga Park, Calif.

CONSTRUCTION AND OPERATION OF THE AE-6 WATER BOILER REACTOR. V. A. Swanson, O. R. Hillig, D. H. Martin, R. A. Laubenstein, C. A. Guderjahn, W. W. Brown, and J. L. Johnson. Aug. 15, 1957. 56p. Contract AT-11-1-GEN-8. $0.40(OTS).

The AE-6 Reactor has been constructed and tested for use in the power range 0 to 2 kw. This reactor is a modification of the Water Boiler Neutron Source. The chief modifications, which were made to permit higher power operation, were the addition of a vapor pressure type gas recombiner and a cooling system. These changes are described and the procedure for critical loading is given. Many of the operating characteristics of the reactor have been experimentally determined and are herein presented. Copies of the operating rules and start-up procedure are also included. (auth)

11423 NAA-SR-1948

Atomic International Div., North American Aviation, Inc., Canoga Park, Calif.

THE TRANSFER FUNCTION OF A WATER BOILER REACTOR. R. E. Skinner and D. L. Hetrick. Aug. 1, 1957. 42p. Contract AT-11-1-GEN-8. $0.30(OTS).

The power and temperature transfer functions for a water boiler reactor are obtained for the case of m groups of delayed neutrons including the effects of temperature and radiolytic gas generation. The nature of the water boiler reactor transfer function is investigated, and impoi - tant results discussed. A number of asymptotic and approximate expressions are given. Representations other than Bode plots are investigated. These include the inverse polar plot, complex power coefficient of reactivity, and modified Nyquist plots. The derivation and limitations of the space-independent reactor kinetics equations used are discussed briefly. (auth)

11424 NAA-SR-1954

Atomic International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTOR SAFETY PROGRESS REPORT [FOR] AUGUST–DECEMBER 1956. Norman C. Miller, ed. Aug. 15, 1957. 21p. Contract AT-11-1-GEN-8. $0.25(OTS).

The lifetime testing of the Mark II Safety Device was resumed; however, four of the six test elements leaked due to excessive rework of parts. The assemblies are being rebuilt using new parts insofar as possible. Further tests on the thin-slab experiment have confirmed the previously obtained value of 112 sec for thermal relaxation time. Tests on the effects of convection and radiation heat loss indicate that higher chamber pressures decrease the thermal relaxation time; the effects were more pronounced with the thinner test slabs. The results of an electrical analog are in reasonable agreement with analytical calculations of the thermal response time of the Mark II fuse. Progress was made on the fabrication and testing of the Mark IV Safety Device. An analytical evaluation of the Mark IV control ratio suggests that the design is 50% superior to the effect of two Mark II elements. Progress is reported on the redesign of the NAA-109-3 test assembly. An electric heater of higher capacity was developed and two fuse subassemblies have been completed and pressure tested. A fission-heated release mechanism for the Power Reactor Safety Device is being developed in which the conductivity of the pad is a direct function of reactor coolant temperature. A transparent experimental model of a rupturable-diaphragm safety element has been constructed to enable visual observation of powdered poison distribution under various experimental conditions, e.g., placement of diaphragms, poison storage, etc. Various approaches are being simultaneously investigated toward the development of a research reactor safety device. (For preceding period see NAA-SR-1810.) (auth)

11425 NAA-SR-Memo-1069

North American Aviation, Inc., [Downey, Calif.].

MULTIGROUP THEORY FOR NON-MULTIPLYING REGIONS AND APPLICATION TO THE SRE SHIELD CALCULATIONS. F. L. Fillmore. Aug. 13, 1954. Decl. Sept. 15, 1955. 21p. $4.80(ph OTS); $2.70(mf OTS).

The neutron flux and current in the SRE shield were calculated in order to evaluate nuclear instrument response, estimate heating effects in the shield, provide a γ-ray source distribution for use in shielding calculations, and determine neutron dosage outside the shield. (M.H.R.)

11426 NACA-TN-3885

Lewis Flight Propulsion Lab., Cleveland.

INVESTIGATION OF TRANSIENT POOL BOILING DUE TO SUDDEN LARGE POWER SURGE. Robert Cole. Dec. 1956. 44p.

The transfer of heat from a metallic ribbon to water, under transient conditions, was studied for initial water temperatures from 76 to 203°F and average heat-generation rates per square foot of surface area of 3, 10, and 20×10^5 Btu per hour per square foot. The tests were conducted at atmospheric pressure under pool boiling conditions. The power surge duration was held constant at 30 msec. An analysis assuming time periods of such short duration that free-convection effects are negligible was successful in predicting ribbon temperatures as a function of time and heat-generation rate in the nonboiling region. A simplified analysis assuming the ribbon to be completely insulated was found to be applicable during time periods in the nonboiling region of short duration. In addition, the analysis was found to be applicable for the entire surge duration under conditions of heat-generation rates well above those required for film boiling. Transient critical heat flux values up to 3×10^6 Btu per hour per square foot were obtained for water at atmospheric pressure. The obtained data indicated an increase in critical heat flux with increase in the degree of subcooling for a constant heat-generation rate, and an increase in critical heat flux with increase in the rate of heat generation for a constant degree of subcooling. (auth)

11427 NP-5887(Add. II)

Mine Safety Appliances Co., Callery, Penna.

INFLUENCE OF TOTAL SOLIDS ON Na-24 AND I-131 AIR ACTIVITY DURING A 550 F-2000 PSIG WATER LEAK. Technical Report No. 46: Addendum II. S. J. Rodgers and J. W. Mausteller. July 8, 1957. 10p. Contract NObs-65426.

Two additional leak experiments have been made, using Na^{24} and I^{131} as co-contaminants in a water system operating at 550°F and 2000 psig. The purposes of the runs were to demonstrate the effect of total solids and the behavior of I^{131}. An increase in the total solids content of 45 to 192 ppm resulted in a 7-fold I^{131} increase and a 4.5-fold Na^{24} decrease in maximum normalized air activity. The 5 to 7 hr required to reach maximum air activity was not af-

fected by the solids content of the water. There was an increase in pH from ~6.0 to 9.3 as a result of the Na_2CO_3 used to increase the total dissolved solids. Iodine chemistry in this environment is not well defined, but the alkaline condition is in the range used in reactor operation. Maximum Na^{24} air activity level was ~17 times the MPL of 2×10 μc/ml and I^{131} activity was ~1000 times the MPL of 3×10^{-9} μc/ml air. Particle size of the air-borne solids was not affected by the solids content of the water, and was >90% in the range of 0.4 to 0.7 microns, as was found in previous runs. Population density of the particles increased with increasing solids content. Fall-out coefficients were similar for Na^{24} and I^{131}, ranging from 0.16 to 0.29/hr. These values agree with those previously found. (auth)

11428 NYO-8500

Ford Instrument Co., New York.

APPLICATION OF DIGITAL TECHNIQUES TO REACTOR CONTROL SYSTEMS. Period Covered: October 29, 1956 to January 31, 1957. Feb. 4, 1957. 14p. Contract AT (30-1)-1969. $3.30(ph OTS); $2.40(mf OTS).

The initial phase of the study is covered. The results of a survey of the control changes desired by four research reactor groups are given. The areas of profitable study indicated by the survey are outlined. The effects of substituting transistor switching circuits in an existing control system are presented from the viewpoint of reliability, maintenance, size, and flexibility. The application of ultrasonics to reactor instrumentation is discussed and recommendations made. Finally, the areas of work following those presented are given. (auth)

11429 ORNL-2225

Oak Ridge National Lab., Tenn.

SPECIFICATIONS FOR ARMY PACKAGE POWER REACTOR (APPR-1) FUEL AND CONTROL ROD COMPONENTS. R. J. Beaver, R. C. Waugh, and C. F. Leitten. Aug. 7, 1957. 41p. Contract W-7405-eng-26. $0.30(OTS).

Final specifications are presented on the stainless steel fuel and control rod components developed for service in the 10 Mw APPR. The specifications cover design and material requirements as well as the fabrication procedures developed and adopted for manufacturing the extended-life fuel element and the enriched B^{10} absorber section of the control rod. Included in the procedural specifications are methods for preparing UO_2-B_4C–stainless steel ceramet cores; techniques for roll-bonding this material into composite stainless steel plates; procedures for brazing these plates into flat-plate fuel units; and the finishing operations required to prepare the assembly for loading into the reactor core. Procedures are also described for manufacturing the absorber sections of the control rod. The procedural specifications are specific for manufacturing these components at ORNL, and merely represent a detailed guide in the event other fuel element fabricators are requested to furnish additional fuel elements and absorber sections. (auth)

11430 WAPD-PWR-CP-2079

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

HIGH-TEMPERATURE STABILITY OF AQUEOUS SOLUTIONS OF REAGENTS THAT ARE POTENTIALLY APPLICATORY TO PWR DECONTAMINATION PROCESSES. H. A. Droll. [1957?]. 16p. $3.30(ph OTS); $2.40(mf OTS).

A series of autoclave experiments was undertaken in an effort to ascertain the behavior of the following reagents in dilute solutions maintained at 300° and 400°F for at least one hour: paraperiodic acid, urea-stabilized H_2O_2, acetanilide-stabilized H_2O_2, catechol (1, 2-dihydroxybenzene), citric acid, and disodium dihydrogen ethylenediaminetetraacetate. The effect of these solutions on the integrity of AISI type 304 stainless steel at 300° and 400°F was also determined by observing weight changes. In general, all of the reagents investigated were observed to decompose, fulfilling every expectation. This was especially true of H_2O_2. Moreover, paraperiodic acid solutions of concentrations equal to or less than 0.02% were found to have decomposed quantitatively to HI and presumably O_2 within five minutes at the both temperatures studied. Indirect measurements (titratable acidity, bromometric titrations, and pH) indicated partial decomposition of citric acid solutions (0.002 to 0.01%) and of catechol solutions (0.003 to 0.01%) to have occurred within fifteen minutes at the experimental temperatures. Finally, an order of magnitude of decomposition may be given by way of illustration; 0.025% EDTA (disodium) solutions exhibited 50% decomposition in three hours at 300° and in less than fifteen minutes at 400°F. (auth)

11431 WAPD-PWR-CP-2719

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

PROPOSED PROCEDURES FOR CHEMICAL DECONTAMINATION OF PWR. [Feb. 1957]. 30p. $4.80(ph OTS); $2.70(mf OTS).

Four general procedures for chemical decontamination of the PWR are discussed: feed-and-bleed with minimum system changes, feed-and-bleed with system changes, fill-and-flush with minimum system changes, and fill-and-flush with system changes. It was found not practical to circulate solution in a closed, solid system with manual control of temperature and pressure. Pressure would be controlled by operating an injection pump against a relief valve. The solutions to be used are described, and the detailed outlines of the procedures are given. (T.R.H.)

11432 WAPD-PWR-CP-2836

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

ANALYSIS OF FEED-AND-BLEED DECONTAMINATION OF A PWR COOLANT LOOP AS PER WAPD-PWR-CP-2719. R. Lloyd. Apr. 3, 1957. 18p. $3.30(ph OTS); $2.40(mf OTS).

An analysis of the feed-and-bleed decontaminating procedure has been made. Equations giving the concentrations of H_2O_2 and O_2 in the coolant loop as a function of time during the decontamination operation have been derived. These equations show the dependency of the H_2O_2 and O_2 concentrations at any time on the feed-and-bleed rate, the purification loop flow, the coolant loop volume, and the rate constant of H_2O_2 decomposition. The rate constant of the decomposition of H_2O_2 in the decontaminating solution at 300°F, 500 psi, in a stainless steel system has been measured. The equations derived have been applied to the decontamination of a PWR coolant loop. The length of a feed-and-bleed decontamination procedure under such conditions that no undissolved O_2 is present in the system has been determined for operation at 300°F and at pressures of 500 and 1000 psi, and the steady state H_2O_2 concentration has been calculated. Optimum operating conditions are recommended for decontaminating a PWR coolant loop by the feed-and-bleed procedure. (auth)

11433 WAPD-PWR-CP-2995

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

CALCULATED DEPOSITED CRUD ACTIVITY IN THE PWR PRIMARY SYSTEM DUE TO CORROSION OF CORE MATERIALS. F. W. Pement. Apr. 23, 1957. 19p. $3.30(ph OTS); $2.40(mf OTS).

The contribution of corrosion products of irradiated core materials to system contamination by particle deposition must be studied so that over-all system contamination

may be evaluated. The deposited crud forms, in effect, a background contamination which would be important in determining over-all system contamination resulting from, for example, failure of a few PWR blanket fuel rods. Corrosion of cobalt-bearing alloys in high flux regions in the core is especially significant in this respect. The purpose of this report is to estimate the deposited activity in the PWR primary system of corrosion products from irradiated core materials. (auth)

11434 WAPD-PWR-Ph-105

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
f, p, AND ϵ MEASUREMENTS ON 0.600 INCH DIAMETER, 1.3% ENRICHED, LOW DENSITY UO_2-FUELED TRX LATTICES. A. Z. Kranz and G. G. Smith. May 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

11435 WAPD-PWR-PMF-693

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
THE EFFECT OF REACTOR COOLANT LEAKAGE INTO THE PWR BOILER WATER. D. J. McDonald. [Mar. 1957]. 6p. Contract [AT-11-1-GEN-14]. $1.80(ph OTS); $1.80(mf OTS).

Attached to this report is WAPD-PWR-PMF-689 with Westinghouse Sketch PFS-32, by J. C. Rengel, dated Mar. 21, 1957. 4p.

The results of a study conducted to predict the magnitude of the buildup of radioactive isotopes in the boiler water of the PWR coolant system steam generators are reported. Only the contribution of the fission product activity from defected fuel elements is considered. (L.T.W.)

11436 WAPD-TM-54

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
POLYPHEMUS: A MONTE CARLO STUDY OF NEUTRON PENETRATIONS THROUGH FINITE WATER SLABS. F. Obenshain, A. Eddy, and H. Kuehn. Jan. 1957. 81p. Contract AT-11-1-GEN-14. $0.50(OTS).

From the analysis of "Neptune," a Monte Carlo feasibility study of 0.89-Mev neutrons in water, it seemed desirable to determine neutron penetrations through water slabs. "Polyphemus" represents this extension to monoenergetic, monodirectional, (as well as isotropic) source neutrons from 1 to 10 Mev. The Polyphemus code was designed to provide two groups of shielding parameters; the neutron dose rates and the dose buildup factors for the several energies. Because it was primarily a production code, emphasis was placed on speed rather than completeness of information. Part of the results were obtained on the New York University UNIVAC, but most of the computing was done on the Westinghouse IBM-704, a machine having a core memory of 4096 words. The code uses one tape which is destroyed after a case is run. The punch and printer are both used, but the drums are not. The program deck will be stored at Westinghouse for any future use. The number of histories calculated for each energy and angle ranged from 1000 at high energies to 44,000 at low energies. The probable error is very small near the source but increases with large penetrations. Thus, the results are more likely to be in error for a large number of mean free paths. (auth)

11437 AEC-tr-2941

PROJECT OF A 420 MW ATOMIC ELECTRIC STATION. (Committee for Participation of U.S.S.R. in International Power Associations.) Translated from Section V.3, Paper 8, presented at the World Power Conference, Belgrade, June 1957. 23p. $0.25(OTS).

11438

THE ATOMIC INDUSTRY AND MECHANICAL ENGINEERING. I. W. J. D. Van Dijck. Atomics 8, 298-301, 295 (1957) Aug.

General aspects, especially problems in reactor construction are dealt with, and new possibilities which are of interest from the point of view of the mechanical engineer are discussed. (auth)

11439

THE ATOMIC INDUSTRY AND MECHANICAL ENGINEERING. 2. E. F. Boon (The Univ., Delft). Atomics 8, 302-8 (1957) Aug.

The effects which the atomic industry has had in stimulating research in mechanical engineering is discussed, with special reference to remote control manipulation, pressure vessels, fuel elements and leak-proof pumps. (auth)

11440

REACTOR RESEARCH IN THE NETHERLANDS. H. R. Kleijn (Univ. of Delft). Atomics 8, 312-15(1957) Aug.

11441

REFERENCE LIST OF BRITISH REACTORS. Nuclear Eng. 2, 320(1957) Aug.

11442

CHEMICAL PROBLEMS IN COOLANT GASES. W. E. Dennis (G.E.C./Simon-Carves Atomic Energy Group). Nuclear Eng. 2, 321-3(1957) Aug.

Processes involving the coolant gas such as the mass transfer of carbon, the oxidation of metals and the removal of moisture should not be viewed as isolated and independent phenomena. In the absence of further information on the effects of irradiation on chemical reactions occurring in the gas circuit only a qualitative picture can be obtained of the gas composition likely to be established during operation. Under what appear to be likely conditions in a CO_2 cooled graphite moderated reactor it may be shown that significant concentrations of hydrogen might be produced by the reduction of H_2O with CO. The water-gas reaction will prevent the accumulation of hydrogen from extraneous sources but may render the removal of moisture more difficult. In the presence of very small concentrations of water vapor the formation of zirconium hydride is thermodynamically possible at all temperatures and cannot, therefore, be neglected in specifying conditions for oxidation tests. (auth)

11443

THE APPR. SOME PROBLEMS AND THEIR SOLUTION. Nuclear Eng. 2, 330-2(1957) Aug.

Some problems faced in design and construction of the APPR are reviewed. Specifically, the problems discussed were incurred in enclosure fabrication and testing, development of control rods and drive mechanisms, sealing problems, stress corrosion, and control-rod flux peaking. (T.R.H.)

11444

THE DFR FUEL ELEMENT. Nuclear Power 2, 329-30 (1957) Aug.

A brief description of the Dounreay Fast Reactor fuel element is given. (T.R.H.)

11445

ENRICHED OR NATURAL URANIUM. W. B. Lewis (Atomic Energy of Canada Ltd.). Nuclear Power 2, 340-1 (1957) Aug.

The economic aspects of the natural U vs. enriched U question are discussed. (T.R.H.)

Refer also to abstract 11038.

NUCLEAR TRANSFORMATION

11446 ANL-5762

Argonne National Lab., Lemont, Ill.

THE RATIO OF THE (n,γ) TO (n,2n) CROSS SECTION FOR THORIUM-232 BOMBARDED WITH FISSION NEUTRONS. R. A. Hasse and P. Kafalas. July 1957. 30p. Contract W-31-109-eng-38. $0.25(OTS).

Th^{232} was exposed to an unmoderated neutron flux produced by U^{235} fission. The ratio of the integrated cross sections for the (n, γ) and (n, 2n) reactions [$\bar{\sigma}$(n, γ)/ $\bar{\sigma}$(n, 2n)] was determined to be 14.0. (auth)

11447 NP-6367

Naval Research Lab., Washington, D. C.

BIBLIOGRAPHY OF PHOTONUCLEAR REACTIONS. Supplement No. 2. Bibliography No. 2. M. Elaine Toms, comp. July 1957. 28p.

Bibliography No. 2 issued as NP-5484. Supplement No. 1 issued as NP-6084.

11448 UCRL-3793

California. Univ., Berkeley. Radiation Lab.

NUCLEAR REACTIONS OF COPPER INDUCED BY 5.7-Bev PROTONS (thesis). Donald W. Barr. May 1957. 100p. Contract W-7405-eng-48. $16.80(ph OTS); $5.70 (mf OTS).

Natural Cu was bombarded with 5.7-Bev protons in the UCRL Bevatron. Formation cross sections for 59 radioactive isotopes from mass number 3 (tritium) to mass number 68 (Ga) are reported. The results are quite different from those found at 340 Mev, in that there is an increased tendency to form products removed from the Cu target by as many as 40 mass units. On the other hand, the experimentally measured cross sections are similar to those found at 2.2 Bev by workers at BNL. The experimental data were treated empirically, and from the results of this analysis, the cross sections were determined for all stable and unmeasured isotopes with a lower atomic number than Cu. A general expression is given, from which any cross section in this study from mass number 22 to 61 may be calculated with a 65% certainty (on the average). The observed distribution of products is discussed in terms of the present ideas on high-energy nuclear reactions, and this distribution is compared to some preliminary theoretical calculations based on a nuclear model that incorporates the above ideas. Observations on the (p,pn) and (p,pπ⁺) reactions on Cu are compared with those found by other workers at lower energies. Th yields of secondary products are discussed. (auth)

11449

NEUTRONS FROM DEUTERON BOMBARDMENT OF BORON. J. R. Bird and R. H. Spear (Univ. of Melbourne). Australian J. Phys. 10, 268-75(1957) June.

A natural B target has been bombarded by 920-kev deuterons, and the emitted neutrons detected using nuclear emulsions. A new procedure for analyzing measurements is described; this procedure allows approximate corrections for errors in geometry in the plane of the emulsions. The dependence of resolution on various experimental factors has been studied, and the resolution achieved is indicated by peak widths of 245 ± 25 and 360 ± 50 kev at neutron energies of 9.7 and 13.9 Mev, respectively. The angular distributions of the neutrons from the $B^{10}(d,n)C^{11}$ reaction corresponding to the ground state of C^{11} and the neutrons from the $B^{11}(d,n)C^{12}$ reaction corresponding to the 7.66-Mev state in C^{12} have been determined; both distributions may be attributed to compound nucleus formation. A search has been made for a neutron group corresponding to an excited state at about 5.5 Mev in C^{12} suggested by Glassgold and Galonsky (1956) on the basis of the α-particle model. An upper limit for the intensity of any such group is set at 1 % of the intensity of the group corresponding to the first excited state in C^{12}. (auth)

11450

DETERMINATION OF PHOTONUCLEAR CROSS SECTIONS. J. H. Carver and K. H. Lokan (Australian National Univ., Canberra). Australian J. Phys. 10, 312-19(1957) June.

11451

EFFECT OF CHANGES IN HYDRATION ON RECOIL FRAGMENTS IN NEUTRON-IRRADIATED PERMANGANATES. J. R. Bolton and K. J. McCallum (Univ. of Saskatchewan, Saskatoon). Can. J. Chem. 35, 761-5(1957) Aug.

Anhydrous and hydrated crystals of sodium and lithium permanganates have been irradiated with neutrons. After irradiation, the crystals were subjected to hydration and dehydration, and the effect of this treatment on the retention of radioactive manganese in the form of the permanganate ion was determined. Hydration of irradiated anhydrous sodium and lithium permanganates decreases the retention observed when the solids are dissolved in basic solutions. Dehydration of the irradiated trihydrate causes little change in the observed retention for sodium permanganate, but a pronounced decrease for lithium permanganate. The significance of the results is discussed. (auth)

11452

B^{12}, C^{12}, AND THE RED GIANTS. C. W. Cook, W. A. Fowler, C. C. Lauritsen, and T. Lauritsen (California Inst. of Tech., Pasadena). Phys. Rev. 107, 508-15(1957) July 15.

Alpha-particle emission associated with the β decay of B^{12} has been detected and the energy spectrum investigated. These studies show that (1.3 ± 0.4)% of all decays of B^{12} lead to the second excited state of C^{12} and that this state breaks up predominantly into three alpha particles with one alpha particle and the ground state of Be^8 as an intermediate stage in the process. The most probable spin and parity assignments for the state appear to be $J = 0^+$, and analysis of the alpha-spectrum yields $Q(C^{12*} - Be^8 - He^4) = 278 \pm 4$ kev, corresponding to an excitation energy in C^{12} of 7.653 ± 0.008 Mev. A new determination of the disintegration energy of Be^8 yields $Q(Be^8 - 2He^4) = 93.7 \pm 0.9$ kev and hence $Q(C^{12*} - 3He^4) = 372 \pm 4$ kev. It is concluded, from the general principle of reversibility of nuclear reactions, that the second excited state of C^{12} as predicted by Hoyle is of a suitable character to act as a stellar thermal resonance in the Salpeter process, $2He^4 \rightleftharpoons Be^8$; $Be^8(\alpha,\gamma)C^{12}$ under conditions expected in red giant stars. (auth)

11453

IONIZATION FOLLOWING INTERNAL CONVERSION IN XENON. Frances Pleasonton and A. H. Snell (Oak Ridge National Lab., Tenn.). Proc. Roy. Soc. (London) A241, 141-52(1957) Aug. 7.

The predominant internal conversion accompanying the decay of 12-day Xe^{131m} from its metastable nuclear level to its stable ground state usually leaves the atoms in states of high multiple ionization, even though only a single primary electron vacancy is created in the initial process. The differential charge spectrum of the ions has been measured by the methods of magnetic analysis. Only 0.62 ± 0.08% of the decays leave the atom singly charged. The most probable state of ionization is 8, following 21.06 ± 0.21% of the nuclear transitions, and corresponding to the depopulation of the outer electron shell. Thereafter the probability of occurrence decreases toward the higher charges, twenty electrons being thrown off in 0.003 ± 0.002% of the decays, which presently is about as far as the sensitivity of the spectrometer carries the spectrum. The mechanism of this multiple ionization is discussed in terms of successive Auger events.

An analysis of the intensity of the singly charged ions in particular suggests that they result predominantly from a combination of direct internal conversion in the outer shell of the atom and of K-shell conversion followed by the (1s–5p) x-ray transition. The upper limit thereby set for the 5p shell conversion coefficient is 0.28, and the upper limit for the intensity of the (1s–5p) line is 0.011 in a total K-series intensity of 1. (auth)

11454

AN INVESTIGATION OF THE REACTION $^{31}P(d,p)^{32}P$ BY MAGNETIC ANALYSIS. A. W. Dalton, S. Hinds, and G. Parry (Univ. of Liverpool). Proc. Phys. Soc. (London) A70, 586-92(1957) Aug.

The energy spectra of the protons emitted from a P target when bombarded by 8.9 Mev deuterons have been measured by magnetic analysis and a number of levels not previously reported have been observed. The angular distributions of 17 proton groups have been measured, and in most cases these have been fitted with theoretical stripping curves enabling parity and possible spin assignments to be made to some states of P^{32}. Seven of these angular distributions show a dip below the Butler stripping curve at small angles, but otherwise correspond to l = 1 transitions. (auth)

11455

PHOTONUCLEAR REACTIONS AND THE GIANT RESONANCE. V. De Sabbata. Nuovo cimento (10) 5, Suppl. No. 1, 243-66(1957). (In Italian)

The mechanism of photonuclear reactions and the indications it gives as to the validity of the various nuclear models are discussed. (M.H.R.)

PARTICLE ACCELERATORS

11456 MURA-320

Midwestern Universities Research Assn., Madison, Wisc.

COMPUTATIONAL EVIDENCE FOR A SPIRALLY-RIDGED FFAG RESONANCE NEAR $3\sigma_x + 2\sigma_y = 2\pi$. L. Jackson Laslett. July 5, 1957. 9p. Contract AT)11-1)-384. $1.80 (ph OTS); $1.80(mf OTS).

Computational evidence of a $3\sigma_x + 2\sigma_y = 2\pi$ resonance is presented for a spirally-ridged fixed-field alternating-gradient accelerator with N = 40, a median-plane field proportional to $1 + 1.1708 \sin 2\pi\xi - 0.2991 \cos 2(2\pi\xi)$, $44.08 \leq k \leq 46.3$, and $1/w = 360 + 1.25(k - 46.0)/0.3$. The computations were performed with the aid of the well-tempered five computational program. The resonance, although not strong, appeared to be definitely present and to exhibit a width approximately proportional to the cube of the radial amplitude. (auth)

11457 MURA-336

Midwestern Universities Research Assn., Madison, Wis.

ON THE DESIGN OF SPIRAL SECTOR ACCELERATORS. Phil L. Morton. Aug. 1, 1957. 49p. Contract AT(11-1)-384. $7.80(ph OTS); $3.30(mf OTS).

The MURA IBM 704 computer was used to study the field variation in the median plane for Spiral Sector FFAG accelerators with various parameters. The results of this study are summarized in the graphs of this report. (auth)

11458

ON THE BETATRON MAGNETIC FIELD. B. I. Rodimov (Tomsk Polytechnic Inst.). Zhur. Tekh. Fiz. 27, 1330-6 (1957) June. (In Russian)

Equations are developed for electron motion in a magnetic betatron field. An equation describing all the properties of the betatron focusing magnetic field was used in calculations of betatron field with fixed properties. (R.V.J.)

11459

CASCADE PHASOTRONS. A. L. Mints and N. K. Kaminskiĭ. Zhur. Tekh. Fiz. 27, 1337-46(1957) June. (In Russian)

The design is given of a multielectrode system for acceleration of charged particles. The performance of the system was checked on a dielectrode cascade phasotron model, and the results of experimental tests are presented. (R.V.J.)

RADIATION ABSORPTION AND SCATTERING

11460 NDA-15-95

Nuclear Development Corp. of America, White Plains, N. Y.

OPERATING INSTRUCTIONS FOR ADDITION OF INELASTIC SCATTERING TO NUPAK. J. Brooks and E. DeDufour. Jan. 22, 1957. 24p. Contract AT(30-1)-862. $4.80(ph OTS); $2.70(mf OTS).

Operating instructions are given for a UNIVAC code which permits computation of constants used in the integration of the moments of the inelastic scattering integral term of the Boltzmann equation, and which incorporates this term in the UNIVAC elastic moment calculation. (auth)

11461 UCRL-3797

California. Univ., Berkeley. Radiation Lab.

COULOMB EXCITATION. John O. Newton. May 29, 1957. 35p. Contract W-7405-eng-48. $1.00(OTS).

In this introduction to the subject of Coulomb excitation, the purely theoretical aspects of the subject are treated only with plausibility considerations in the semiclassical approximation, so as to give an idea of the physical ideas involved. The results derived from the theoretical analysis are, however, considered in detail. In general the discussion is directed towards experimentalists who have available machines that are not limited by bombarding energy and give beams of heavy ions; such machines are just coming into operation at Berkeley and Yale. The report should, however, still be of use to others who do not possess these facilities. A set of graphs useful for the interpretation of experimental results is given. (auth)

11462 WIAP-NM-58

Westinghouse Electric Corp. Industrial Atomic Power [Group], Pittsburgh.

ATTENUATION OF NEUTRONS IN NON-SCATTERING ABSORBERS. J. M. Stein. Mar. 1955. 11p. $3.30 (ph OTS); $2.40(mf OTS).

The calculation of neutron absorption in materials in which the scattering cross section is small compared with the absorption cross section has many applications in reactor problems. The nonscattering transport equation is solved for various geometries and satisfying boundary conditions consistent with diffusion theory which is applicable in the neighboring medium. (M.H.R.)

11463

THEORY OF HIGH-ENERGY DEUTERON SCATTERING. Henry P. Stapp (Univ. of California, Berkeley). Phys. Rev. 107, 607-15(1957) July.

The scattering of high-energy deuterons from spin-zero targets is treated in the framework of the impluse approximation, using the polarization formalism of Wolfenstein and Ashkin, which is here extended to the case of spin-1 particles. The contributions of the deuteron D-state are included and are found to be important in large-angle scattering. The contributions to the deuteron scattering due to the simultaneous scattering of both particles of the deuteron are also included. These contributions are treated

by a multitime formalism similar to that used in the Bethe-Salpeter and Lévy-Klein approach to the relativistic two-body wave equation, but here a slightly different assumption regarding the relative time dependence is made. It is found that these contributions are important at both large and small scattering angles, and account for the large disparity between the experimental and theoretical values of the differential cross section obtained in previous calculations. (auth)

11464

AN ANALOGUE METHOD FOR STUDYING MULTIPLE SCATTERING. J. C. Barton, D. A. Campbell, and R. C. Read (Univ. Coll. of West Indies). Proc. Phys. Soc. (London) A70, 605-14(1957) Aug.

A source of random motion was coupled to a mechanical differential analyzer so that the output simulated the behavior of a high energy charged particle undergoing multiple scattering. A large number of track analogues were drawn and their statistical behavior studied. They provided an experimental test of the theory for the first passage problem of multiple scattering. (auth)

11465

THE BACKSCATTERING OF BETA-PARTICLES FROM GASES. William P. Jesse and John Sadauskis (Argonne National Lab., Lemont, Ill.). Radiation Research 7, 167-75 (1957) Aug.

In addition to the effect of the backscattering of β particles from the sample mount, which is a well-known source of distortion in absolute β-ray measurements, one must recognize a second, less well-known type of distortion of current values in an ionization chamber. This distortion, with which these experiments deal, results from a scattering of the β particles from the gas in the chamber back to the sample mount. This loss in ionization current has in the most general case been found to be a function of the atomic number of the gas used, the pressure of the gas used, and the size and conformation of the sample mount. This gaseous backscattering can probably best be minimized by the same technique which avoids backscattering from the sample mount itself, that is, by deposition of the β particle source upon a very thin film. A large number of the β particles which are backscattered will then pass directly through the film with a minimum loss of energy. The retaining ring, upon which such a thin film is usually mounted, may, however, present an appreciable area of interception. Hence its dimensions should be reduced to a minimum to avoid errors in precise absolute ionization measurements. In measurements with a proportional counter this gaseous backscattering would seem to be less troublesome than in an ionization chamber, so long as one is interested in recording with the counter only the absolute number of β particles emitted per second, as is usually the case. Here a β particle which has emerged into the gas and been backscattered has in all probability produced along its path enough ions to exceed the minimum response threshold of the counter. Hence it produces a recorded count, even though its total energy may have been greatly reduced by its final interception by the sample mount. If, however, the objective of the proportional counter measurements is not simply to measure the β-ray emission rate but is to map the energy distribution in the β-ray spectrum, then the gaseous backscattering assumes a new importance. Here it may produce marked distortions in such a measured spectrum, and precautions similar to those indicated for ionization measurements would then have to be taken to ensure precise results. (auth)

11466

X-RAY ATTENUATION COEFFICIENTS FROM 10 Kev TO 100 Mev. NBS CIRCULAR 583. Gladys White Grodstein. Washington, U. S. Department of Commerce, 1957. 56p. Available from U. S. Government Printing Office for $0.35.

A tabulation of attenuation coefficients of x rays and gamma rays from 0.01 to 100 Mev for 29 materials is presented. A summary of information on the probability of the basic interaction processes of photons with matter and a detailed analysis of experimental and theoretical evidence are included. Present information on the basic processes is adequate for many applications: however, improved theory and additional experimental data are needed in certain areas. A comparison of calculated and experimental coefficients points up this need. (auth)

11467

THE INELASTIC SCATTERING OF 14 MEV NEUTRONS BY ATOMIC NUCLEI. V. I. Strizhak. J. Nuclear Energy 5, 253-4(1957).

11468

CONTRIBUTION TO ELASTIC SCATTERING FROM INELASTIC PROCESSES: APPLICATION TO HIGH-ENERGY ELECTRON SCATTERING FROM HYDROGEN AND DEUTERIUM. H. S. Valk (Washington Univ., St. Louis, Mo.). Nuovo cimento (10) 6, 173-86(1957) July.

An expression is derived in first Born approximation for the correction to high-energy elastic electron-nucleus scattering arising from the existence of nonradiative inelastic processes. The magnitude of this correction is estimated for electron-proton and electron-deuteron scattering and is shown to be a very small but rapidly increasing function of energy over the range of incident electron energies from 150 to 450 Mev. The correction to electron-deuteron scattering also shows a marked angular dependence increasing with increasing scattering angle. (auth)

RADIATION EFFECTS

11469 BNL-3275

Brookhaven National Lab., Upton, N. Y.

DEFECTS IN SOLIDS AND CURRENT CONCEPTS OF RADIATION EFFECTS. G. J. Dienes. [Mar. 1957]. 91p. $13.80(ph OTS); $4.80(mf OTS).

Calculations and measurements of displaced atoms produced by nuclear radiation are given and discussed. (T.R.H.)

11470 CF-56-12-116(Rev.)

Oak Ridge National Lab., Tenn.

IRRADIATION EXPERIMENT ON ALUMINUM FUEL ELEMENT CONTAINING U_3O_8 DISPERSION. R. J. Beaver. July 15, 1957. 6p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

The irradiation behavior of Al plate-type fuel elements, in which the U was incorporated as a dispersion of U_3O_8 in Al, is presented. (W.L.H.)

11471 NARF-57-19T(Vol. 1)

Convair, Fort Worth, Tex.

FIRST SEMI-ANNUAL RADIATION EFFECTS SYMPOSIUM, FORT WORTH, TEXAS, MAY 22–23, 1957. 182p. (FZK-9-118(Vol.1)).

Papers on radiation effects on materials associated with the development of nuclear powered weapon systems are presented. The particular materials involved in the investigations reported are semiconductors and transistors, lubricants, silicone rubbers, ignition exciter unit, hydraulic fluids, fuels, and organic selenides. Other papers are presented on An Analytical Approach to ANP Radiation Effects Problems, Dosimetry Requirements for Accurate Evaluation of ANP Radiation Problems, and Reduction of Radiation Measurements to a Common Unit. (T.R.H.)

11472 NP-6391

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

ACCESSION LIST NO. 1 [ON RADIATION EFFECTS DATA]. July 15, 1957. 12p. Project No. 2133. Contract AF33(616)-5171.

11473 NP-6405

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

ACCESSION LIST NO. 2 [ON RADIATION EFFECTS DATA]. Aug. 15, 1957. 32p. Project No. 2133. Contract AF33(616)-5171.

11474 WADC-TN-57-120

Wright Air Development Center. Electronic Components Lab., Wright-Patterson AFB, Ohio.

AIEE TRANSACTION PAPER ON THE EFFECTS OF NUCLEAR RADIATION ON ELECTRONIC COMPONENTS AND SYSTEMS. J. Robert Milliron. Mar. 27, 1957. 8p. (AD-118202; PB-131051).

The usual causes and effects of reactor radiation on electronic components and systems are briefly reviewed. It was observed that damage resulting from nuclear radiation is a function of type and energy of the radiation, as well as other environmental factors, such as temperature, humidity, stress, and rate of irradiation. (auth)

11475

EFFECTS OF ATOMIC EXPLOSIONS ON METEOROLOGICAL PROCESSES. J. K. Fedorow. Atomkern Energie 2, 266-72(1957) July. (In German)

11476

IONIZING RADIATIONS. E. Alfred Burrill (High Voltage Engineering Corp., Burlington, Mass.). Chem. Eng. 64, No. 9, 235-41(1957) Sept.

The production, application, and economics of high-speed electrons and other ionizing radiations as a processing tool are discussed. (auth)

11477

THE DISPLACEMENT OF ATOMS IN POLONIUM AND ITS COMPOUNDS BY RADIOACTIVE DECAY. R. W. M. D'Eye (Atomic Energy Research Establishment, Harwell, Nr. Didcot, Berks). J. Inorg. and Nuclear Chem. 4, 367-9 (1957).

The number of Po atoms likely to be displaced from their normal lattice sites by α particles or recoiling nuclei is calculated to be 2×10^{19}/day. The importance of this fact in in explaining phase transitions is discussed. (T.R.H.)

11478

IRRADIATION EFFECTS IN BOROSILICATE GLASS. Bernhard Gross. Phys. Rev. 107, 368-73(1957) July 15.

Irradiation of thick samples of borosilicate glass with high-energy electrons introduces space charges into the dielectric, the decay of which is extremely slow at room temperature. The charged dielectric shows a behavior similar to that of an electret; charges are induced on adjacent conductors and short-circuit discharge currents are observed during heating. The nature of the charges of the dielectric, annealing effects, and discharge mechanism were investigated. It is shown that the dielectric contains charges of two types: a negative charge constituted by arrested irradiation electrons and a positive compensation charge. (auth)

11479

DIFFUSION-LIMITED ANNEALING OF RADIATION DAMAGE IN GERMANIUM. T. R. Waite (Bell Telephone Labs., Murray Hill, J. J.). Phys. Rev. 107, 471-8(1957) July 15.

The theory of the previous paper in this journal was used to treat the annealing of radiation damage in n-type Ge as studied by Fletcher, Brown, and Wright, and by Augustyniak. The damage was produced by 3-Mev electrons to a density of 10^{15} defects/cc. The damage was assumed to have consisted of vacancy-interstitial pairs which annealed by the diffusion together of interstitials and vacancies. A reasonable fit of the data has been obtained for the initial 50% of the annealing. The data of Augustyniak were fit for all stages of the annealing process. Choice of parameters to fit the data led to the following conclusions: The sum of the diffusion coefficients of interstitials and vacancies is given by $10^{11}\, r_0^2 \exp(-31.6\ \text{kcal/RT})$, where r_0 is the capture radius; the average separation of the interstitial and the vacancy of the pairs produced by 3-Mev electrons is approximately 1.5 r_0, and the first 65% of the annealing occurs by the recombination of each interstitial with the vacancy from which it was originally dislodged. Fair agreement of the activation energy with the previously accepted activation energy for vacancy diffusion suggests vacancy-diffusion annealing. Absence of a more rapid interstitial diffusion indicates that the interstitial does not possess the contracted electron cloud of a positive ion. (auth)

11480

AN X-RAY STUDY OF NEUTRON IRRADIATED LITHIUM FLUORIDE. R. E. Smallman and B. T. M. Willis (A.E.R.E. Harwell, Nr. Didcot, Eng.). Phil. Mag. (8) 2, 1018-26 (1957) Aug.

The nature of the damage in neutron irradiated LiF has been examined by x rays up to neutron doses at which the majority of the ions have been displaced from their lattice sites. The observations have been made by Debye-Scherrer powder photography, Laue photography and small-angle scattering. The results indicate that isolated defects predominate at low doses, but that these cluster to form large defects at doses higher than about 10^{17} neutrons/cm^2. With the exception of some small-angle scattering all the x ray effects anneal out in the range 400 to 500°C. This residual scattering is interpreted as that associated with gas bubbles. (auth)

RADIOACTIVITY

11481

ALPHA DECAY IN PLUTONIUM-237. Darleane C. Hoffman (Los Alamos Scientific Lab., N. Mex.). J. Inorg. and Nuclear Chem. 4, 383-5(1957).

11482

LONGITUDINAL POLARIZATION OF BETA-PARTICLES FROM ^{60}Co, ^{32}P, AND ^{170}Tm. H. De Waard and O. J. Poppema. Physica 23, 597-8(1957) July.

11483

ANISOTROPY AND POLARIZATION OF GAMMA RAYS EMITTED BY ORIENTATED ^{52}Mn NUCLEI. W. J. Huiskamp, A. N. Diddens, J. C. Severiens, A. R. Miedema, and M. J. Steenland. Physica 23, 605-21(1957) July.

Measurements of the anisotropy of the intensity distribution of the 3 gamma rays emitted by polarized Mn^{52} nuclei yielded the value of the nuclear magnetic moment $\mu = 2.8(+0.8, -0.5)\mu_N$. The sign of the nuclear magnetic moment was shown to be positive from the measurement of the circular polarization of the gamma rays. It was concluded from the linear polarization of the gamma rays that these are all electric quadrupole radiations. Results obtained with aligned nuclei are also reported. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

11484 NP-6386

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

INVESTIGATION OF FUNDAMENTAL PROPERTIES OF ELEMENTS AND THEIR COMPOUNDS INCLUDING THE RARE EARTHS AT VERY LOW TEMPERATURES WITH PARTICULAR EMPHASIS UPON SUPERCONDUCTIVITY. Final Report. W. T. Ziegler. June 30, 1957. 22p. Project No. 116-18. Contract N6-ori-192, Task Order I.

Results are presented of research made on the superconductivity of rare-earth metals, rare-earth compounds, and transition metals and their compounds. The rare-earth chemistry and low temperature calorimetric data obtained during the research are summarized. (R.V.J.)

SHIELDING

11485

RADIATION SHIELDING. B. T. Price, C. C. Horton, and K. T. Spinney. New York, Pergamon Press, 1957. 358p.

Topics are included on the biological hazards of nuclear radiations, attenuation of γ rays and high-energy electrons, shielding against neutrons and neutron physics, neutron attenuation in thick shields, useful mathematical formulas, and the shielding of reactors and radioactive materials. (M.H.R.)

SPECTROSCOPY

11486

TECHNIQUES AND APPARATUS FOR LONGWAVE INFRARED SPECTROSCOPY. N. G. Yaroslavskiĭ. Uspekhi Fiz. Nauk 62, No. 2, 159-86(1957) June. (In Russian)

Techniques, methods, and apparatus developed abroad and in the U.S.S.R. for obtaining and recording long wave spectra up to 1600 μ are described. (R.V.J.)

THEORETICAL PHYSICS

11487 AEC-tr-2876

QUANTUM ELECTRODYNAMICS. (Kvantovaya Elektrodinamika). A. I. Akhiezer and V. B. Berestetskii (Berestetsky). Translated from a publication of the State Technico-Theoretical Literature Press, Moscow, 1953. (Issued in two parts: Pt. I, 292p. and Pt. II, 257p.) $2.65 (OTS).

A manual is presented, in two parts, of quantum electrodynamics including both the elements of the theory and applications to the calculation of various effects. (R.V.J.)

11488

ERGODIC THEOREM FOR INTERACTING SYSTEMS. H. Ekstein (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 333-6(1957) July 15.

von Neumann has proved a quantum-mechanical ergodic theorem which deals with a closed macroscopic system and macroscopic observables. Certain unsatisfactory features of this theorem are probably due to the overly-strong idealization of a completely closed system. Since the claims of statistical mechanics go beyond macroscopic systems, there is a need for a more general theorem. A system of any number of degrees of freedom and with any observable, during interaction with a temperature bath is studied. In order to avoid an assumption of randomness, the bath must be described explicitly and precisely by a time-independent Hamiltonian. The model of the bath is obtained by taking the Gibbs ensemble seriously, i.e., as a set of N identical systems interacting through a potential λV. The following theorem is proved. The time average of the quantum-mechanical expectation value of any observable with respect to any initial state is equal to its statistical average, in the double limit $N \to \infty$, $\lambda \to 0$, for the overwhelming majority of all interaction potentials V. (auth)

URANIUM AND URANIUM COMPOUNDS

11489 AECD-4243

Los Alamos Scientific Lab., N. Mex.

ESTIMATED CRITICAL MASSES OF DILUTED ORALLOY. Hugh C. Paxton. June 1956. Decl. Aug. 30, 1956. 4p. Contract W-7405-Eng-36. $1.80(ph OTS); $1.80(mf OTS).

11490 DM-44

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE SIGNIFICANCE OF DEVELOPING A HIGH PERFORMANCE URANIUM OXIDE FUEL. W. B. Lewis. Apr. 27, 1957. 21p. (AECL-478).

It appears that comparing flat with round rods of unenriched UO_2, the flats have two advantages. First the neutron losses to the sheathing are lower because the surface heat transfer rates can be higher. Second, it is not so advantageous to run the fuel near its melting point. On the other hand, however, the deformation that is likely to result if the fuel melted is likely to be a serious defect, so that it may be necessary to operate safely below the melting point. Round rods have the advantage of a background of satisfactory experience even under conditions where the core melts. The analysis presented shows the importance of developing UO_2 fuel. Possible lines of development would seem to lie in the direction of increasing the thermal conductivity k by the introduction of some metal of low neutron absorption that would not have too high a vapor pressure at its operating temperature. In reactor design in the absence of an improved fuel, careful consideration must be given to optimizing a very complex set of interrelated characteristics. For the minimum fuelling cost in the long run it appears that a high maximum neutron flux is to be avoided. (auth)

11491 ORNL-2127(Pt. 1(Vols. 1 and 2))

Oak Ridge National Lab., Tenn.

URANIUM-235 FISSION-PRODUCT PRODUCTION AS A FUNCTION OF THERMAL NEUTRON FLUX, IRRADIATION TIME, AND DECAY TIME. I. ATOMIC CONCENTRATIONS AND GROSS TOTALS. J. O. Blomeke and Mary F. Todd. Aug. 19, 1957. (Issued in two volumes: Vol. 1, 216p. and Vol. 2, 220p). Contract W-7405-eng-26. $1.75(OTS).

Levels of fission products resulting from thermal fission of U^{235} in reactor fuels were computed over a wide range of reactor operating conditions and decay times. Values for approximately 300 fission products are presented in graphical form together with gross totals of their activities, radiation powers, and thermal neutron poisoning. The γ spectrum is further broken into four groups of specified energy ranges, which are suitable for use in shielding design. Tabulations of these properties are arranged as to chain or mass number, element, and as to the rare-gas and rare-earth groups. The calculations assume constant replenishment of U^{235}, constant reactor power operation, and no fission-product separations during irradiation. (auth)

11492 ORNL-2320

Oak Ridge National Lab., Tenn.

FISSION FRAGMENT STUDIES BY MAGNETIC ANALYSIS.

Clyde Benson Fulmer. Aug. 22, 1957. 97p. Contract W-7405-eng-26. $0.50(OTS).

Various properties of U^{235} fission fragments were studied with a high resolution magnetic spectrograph. The equilibrium charge of fragments in gas were studied as a function of fragment velocity, gas pressure, and type of gas. The mean radioactive lifetime of excited ionized fission fragments was determined. A thin CsI(Tl) crystal was successfully used to detect the fragments in a high background of gamma and beta radiation; the scintillation response of the crystal to fission fragments was studied. No saturation was observed. Energy vs range curves were obtained for median light and heavy fission fragments in H_2, He, air, A, Al, Ni, and Au. The long range particles from fission of U^{235} were verified to be alpha particles; the energy distribution of the particles was determined with high resolution, and no fine structure was found. The capabilities of a magnetic fission-fragment mass separator were studied. This study yielded a measure of the nuclear charge distribution of fission fragments of a given mass. (auth)

11493 TID-5223

Argonne National Lab., Lemont, Ill.

PRODUCTION AND SEPARATION OF U^{233}. Collected Papers. Leonard I. Katzin, ed. 1952. Decl. with deletions Jan. 11, 1957. (Issued in two parts: TID-5223(Pt. 1), 420p. and TID-5223(Pt. 2), 323p.) $3.25(OTS).

This is a deleted version of NNES-IV-17B.

The assembled record of the significant work relating to U^{233} done on the Manhattan Project up to July 1945 is presented. About 80 papers are presented. The papers included are: A new Fissionable Isotope of U: U^{233}; Determination of the Half Life of U^{233}; Radiation Spectrum of the Transition of U^{233} to Th^{229}; The (4n + 1) Radioactive Series: Decay products of U^{233}; Fast Neutron Fission of U^{233}, Pa^{231}, and Pu^{239}; Abundance of U^{238} in samples of U^{233}; Spontaneous-Fission Rate of U^{234}; Further Search for Spontaneous Fission in U^{234}; Test for Slow-Neutron Fission of U^{234}; New Isotopes of Pa and U: Pa^{232} and U^{232}; Neutron Absorption and Production by U^{233}; Eta for U^{233}; Volatilization of Pa from Th in a stream of HF; A MnO_2 Procedure for Isolation and Concentration of Pa from Irradiated Th Compounds; Isolation of U without Carrier from Th Metal Bombarded with Deuterons; Feasibility of Separating U^{233} from Th and Pa^{233} by Solvent Extraction; Removal of U from Th by Means of a Semi-Continuous Solvent Extractor; Some General Solvent Extraction Considerations; Theoretical Consideration of Ether Extraction of $UO_2(NO_3)_2$ from Aqueous Solutions Containing Various Metal Nitrate Salting Agents; Influence of Various Nitrates on Diethyl Ether Extraction of Low Concentrations of U from Th; Solvent Extraction of U^{233} from Highly Radioactive Material; A Remotely Controlled Laboratory Scale Apparatus; A Laboratory Metering Pump; Isolation of the First Milligram Quantities of U^{233}; A Continuous–Batch Solvent Extraction Apparatus; Study of ThO_2 Slurries; Analysis of Ore Residues for Pa and Th; Extraction of Pa from Carbonate Insoluble Residues of U Ores: I. Isolation and Purification of Pa Using HF, II. "Gel Procedure" for Isolation of Pa, III. MnO_2 Procedure; Half Life of Pa^{231}; Solubility of Pa in Common Acids; Chemistry of Pa: I. Some Observations on Solvent Extraction of Pa, II. Analysis of Ore Residues for Pa; Dissolution of Th and ThO_2 in HNO_3–HF and HNO_3–$(NH_4)_2SiF_6$ Mixtures; A study of the Peroxides of Th; A study of Thorium Peroxide Sulfate; Note on Electrolysis of $ThCl_4$ from Fused Salts; Note on Methods of Purification and Analysis of Anhydrous $ThCl_4$; A Physical Study of the Th–H_2 System; Complex Ions Formed by Th and Fe with Fluoride in Acid Solution; Preparation of Binary Compounds of Th from Th Metal; Precipitation of $Th(C_2O_4)_2$ from HNO_3 Solutions; Note on the Effect of HCl Concentration on Heat of Solution of $ThCl_4$; Precipitation of $Th(NO_3$ $Th(C_2O_4)_2$; A Method of Recovering Th from Slag; Preparation of Anhydrous ThF_4 for Metal Production; Production of Th by Metallothermic Reduction of ThF_4; Casting of Th and Some Properties of the Cast Metal; A Pilot Plant for Purification of $Th(NO_3)_4$ by Countercurrent Extraction; Extraction Purification of $Th(NO_3)_4$; Thermal Neutron Fission Cross Section of Th^{229}; The Protactinium Radioactive Series; Thermal Neutron Capture Cross Section of Th^{230} by Measurement of Th^{231}; Thermal Neutron Fission Properties of Pa^{233}; Determination of Thermal Neutron Capture Cross Section of Pa^{233}; A New Isotope: Pa^{229}; Determination of Half Life of Th^{230}; Products of Deuteron and He ion Bombardments of Pa^{231}; Thermal Neutron Fission Properties of Th^{228}, U^{232}, Pa^{231}, Th^{232}, and Th^{230}; Counting Efficiency of a Mica-Window G-M Tube for 0.3 Mev γ-rays; Gamma-Ray Emission by U^{235}; Thermal Neutron Capture Cross Section of Pa^{231}; A Simple Electronic Device for Measurement of Short Half Lives; The Half Life of Rn^{218}; Half Life of Th^{227}; Thermal Neutron Fission Properties of Th^{227}: Half Life of Pa^{232}; Study of Radiation Characteristics of 6.8d U^{237}; Yield of 6.8d U^{237} in Cyclotron and Pile; Determination of Th^{234} Activity (II); Gamma Radiation of $U^{235}(Th^{231})$; Radiations of Pa^{232}; Report on Radiations of Th^{231}; and Upper Limit to Absorption Cross Section of U^{236}. (T.R.H.)

11494 AEC-tr-2995

OBSERVATION OF URANIUM WITH A FIELD-EMISSION MICROSCOPE. M. Sternberg. Translated by K. S. Bevis from Compt. rend. 242, 1307-9(1956). 2p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-8073.

11495

HALL EFFECT OF URANIUM. F. Boeschoten and C. Huiszoon. Physica 23, 704(1957) July.

PATENTS

CHEMISTRY

11496

CHEMICAL TREATMENT OF PLUTONIUM HEXAFLUORIDE AND URANIUM HEXAFLUORIDE. R. Hurst and H. K. Ray (to U. K. Atomic Energy Authority). British Patent 772,617. Nuclear Eng. 2, 350(1957) Aug.

If PuF_6 or UF_6 vapor is passed into strong H_2SO_4, a sulfate of plutonium or uranium becomes deposited as small crystals from the H_2SO_4. The process may be used in connection with a homogeneous nuclear reactor with a solution of UO_2SO_4 and a ThO_2 blanket. Uranium hexafluoride extracted by means of fluoride from the blanket can then be converted into UO_2SO_4 for the reactor core. (auth)

11497

LEACHING OF URANIUM ORES USING ALKALI-METAL OR AMMONIUM CARBONATE AND BICARBONATE. (to Minister of Mines and Technical Surveys of Canada (Canada)). British Patent 772,867. Nuclear Eng. 2, 350(1957) Aug.

It has been found that a continuous supply of oxygen and carbon dioxide efficiently maintains oxidizing conditions during the leach and sustains the bicarbonate content of the leach solution. The process enables the extraction of uranium without the necessity of operating under greater than atmospheric pressures. (auth)

11498

SOLVENT EXTRACTION PROCESS FOR THE SEPARATION OF TANTALUM AND NIOBIUM VALUES. H. G. Hicks et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,795,481. June 11, 1957.

A process of separation of Ta from Nb is given. The process consists in extracting, with diisopropyl ketone, an aqueous hydrofluoric acid-mineral acid solution of a mixture of Nb and Ta. Tantalum extracts into the ketone; the Nb remains in the water. Tantalum may be recovered by adding H_3BO_3 to the combined washings from the extraction to complex the fluorides, and precipitating the metal as the hydrated oxide by adding NH_4OH. (auth)

11499

METHOD FOR CONVERTING URANIUM AMMONIUM PHOSPHATE TO URANYL FLUORIDE. S. Bernstein and H. A. Bernhardt (to U. S. Atomic Energy Commission). U. S. Patent 2,795,479. June 11, 1957.

A method for converting $UO_2NH_3PO_4$ to UO_2F_2 is given. This conversion is effected by heating the $UO_2NH_3PO_4$ within a narrow temperature range, preferably at about 450°C, until it is converted into UO_2HPO_4, and then contacting the resulting UO_2HPO_4 with HF at a temperature, of about 500°C until it is converted into the desired UO_2F_2. (auth)

11500

RECOVERY OF URANIUM FROM AQUEOUS PHOSPHATE CONTAINING SOLUTIONS. E. F. Stephan and G. A. Lutz (to U. S. Atomic Energy Commission). U. S. Patent 2,795,480. June 11, 1957.

The recovery of U present as UO_2^{2+} in small concentration in aqueous acidic phosphate solutions is described. The U values may be recovered in good yield from aqueous phosphate acid solution made from rock phosphate by contacting such a solution with an anion exchange resin. Uranium values are recovered from the resin by elution with a suitable agent, such as 1 N HCl or 1 N NaOH containing about 1% of H_2O_2. The acidity of the solution from which the U is to be recovered is not critical. It has also been found advisable for optimum U recovery to convert all U present in the solution to the UO_2^{2+} form before contacting solution with the anion exchange resin by treating with a small amount of an oxidizing agent such as $KMnO_4$. (auth)

11501

SOLVENT EXTRACTION PROCESS FOR PURIFICATION OF THORIUM. F. H. Spedding and A. Kant (to U. S. Atomic Energy Commission). U. S. Patent 2,796,320. June 18, 1957.

The separation and purification of Th are described. This purification of Th can be made by extracting an aqueous Th salt solution by means of a liquid organic solvent. Satisfactory organic solvents include ethers, esters, ketones, alcohols and alkyl phosphates. The extraction process also calls for the use of very water-soluble nitrate or chloride as a salting-out agent. (auth)

11502

ABSORPTION OF IODINE VAPOR. Ralph McNabney (to U. S. Atomic Energy Commission). U. S. Patent 2,795,482. June 11, 1957.

The recovery of I_2 from gaseous mixtures containing relatively small amounts of elemental iodine in vapor form is described. The method consists in preparing an inert carrier having silver-bearing surface areas and passing the mixed gas over the carrier under conditions which cause the elemental iodine to react with the Ag to produce AgI. Preferred results are obtained by using a layer of a Ag salt such as $AgNO_3$ on the carrier material. (auth)

11503

CONVERSION OF DIMETHYL ETHER–BORON TRIFLUORIDE COMPLEX TO POTASSIUM FLUOBORATE. A. R. Eberle (to U. S. Atomic Energy Commission). U. S. Patent 2,796,323. June 18, 1957.

A method of preparing KBF_4 from the dimethyl ether complex of BF_3 is given. This may be accomplished by introducing the dimethyl ether complex of BF_3 into an aqueous solution of KF and alcohol, expelling the ether liberated from the complex by heating or stirring and recovering the KBF_4 so formed. The KBF_4 is then filtered from the alcohol-water solution, which may be recycled, to reduce the loss of KBF_4 which is not recovered by filtration. (auth)

11504

PROCESS AND ELECTROLYTE FOR THE ELECTRODEPOSITION OF ZIRCONIUM. Milton H. Lietzke (to U. S. Atomic Energy Commission). U. S. Patent 2,796,392. June 18, 1957.

A method and plating bath for coating U with Zr by electrodeposition are presented. The U object to be coated is first cleaned by any method which will provide a completely clean, bright, metallic surface, and is then immersed in the plating bath. The plating baths which may be employed comprise fused mixtures of a zirconium tetrahalide and an alkyl pyridinium halide, for example, ethyl pyridinium chloride. The plating temperature may vary but can generally be any temperature above the fusion point and below the decomposition temperature of the alkyl pyridinium halide employed. (auth)

11505

PROCESS OF RECOVERING URANIUM FROM CALUTRON WASH SOLUTIONS. R. Q. Boyer (to U. S. Atomic Energy Commission). U. S. Patent 2,796,393. June 18, 1957.

A process is given for treating calutron wash solutions to reclaim U values therefrom. The parts of a calutron upon which U is deposited are washed with a solvent for the U, whereby UO_2^{2+} and the ions of metal impurities such as Fe, Cr, and Ni are introduced in the wash solution. The wash solution is first subjected to a reducing treatment to convert the UO_2^{2+} into U^{4+} in the solution, and then treated with a stoichiometric excess of oxalic and hydrochloric acids to precipitate the U as $U(C_2O_4)_2$ away from metal impurities in the solution. The wet $U(C_2O_4)_2$ precipitate is then contacted with a suitable liquid drying agent, whereby the wet $U(C_2O_4)_2$ precipitate is dried, and thereafter the dried $U(C_2O_4)_2$ precipitate is calcined to produce a uranium oxide. (auth)

11506

SEPARATION PROCESS BY ADSORPTION. W. W. Schulz et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,796,424. June 18, 1957.

The process of this invention is applicable to the separation of Ru and Zr and/or Nb values from aqueous raffinate solutions containing U obtained when neutron-irradiated U is processed to recover Pu. This separation is accomplished by adding to an aqueous solution containing mineral acid salts of U, Ru, Zr or Nb, an organic-sulfo compound such as a mercaptan, thioether or alkyl disulfide, whereby the Ru salt is complexed, and passing the solution over silica gel whereby the Ru complex, the Nb and Zr salts are adsorbed on said silica gel. (auth)

11507

METHOD OF REDUCING HEAVY METAL TETRAHALIDES. J. J. Katz (to U. S. Atomic Energy Commission). U. S. Patent 2,797,142. June 25, 1957.

A process is given for the reduction of uranium tetra-

halides other than the tetrafluoride. These uranium tetrahalides can be reduced by treating an ether solution of the uranium tetrahalide with an alkali metal aluminum hydride. The reaction will occur at room temperature, and will even take place at temperatures as low as −80°C. The alkali metal aluminum hydride added to the ether solution may be incorporated as such or may be formed in situ. In the latter case, an aluminum halide is added to the ether solution of uranium tetrahalide, and the resultant solution is contacted with alkali metal hydride. (auth)

11508

URANIUM-VANADIUM RECOVERY AND SEPARATION BY PHOSPHATE PRECIPITATION. W. F. Arendale et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,797,143. June 25, 1957.

A process for recovering both the U and V values from carnotite type ores is described. This is done by reducing the dissolved U and V in the leach liquor to the 4 valence and 3 valence states, respectively, and adding PO_4^{3-} to the reduced solution to precipitate uranium phosphate by adjusting the pH to a range of 1.0 to 1.5. The precipitate is then subjected to an alkali metathesis, thereby converting the U to uranium oxide product and solubilizing any residual V therein. The supernatant from the U precipitation step and the mother liquor from the metathesis step are combined and the pH adjusted to a range of 2.5 to 3.1 to precipitate V as the phosphate. This precipitate is removed, wasted and water leached to recover the solubilized V content. (auth)

11509

PRODUCTION OF ZIRCONIUM. F. H. Spedding et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,797,160. June 25, 1957.

A process for the production of Zr or Zr-base alloys from ZrF_4 is given. This is accomplished by preparing a mixture of ZrF_4 and a reducing metal and heating this mixture in a closed reactor. Alkali metals and alkaline earth metals are suitable as reducing agents, and in particular Mg and Ca have been found to yield satisfactory results. A booster material, such as I_2 or S, is added to the reaction mixture, or an alloying metal in the form of a compound which functions as a booster may be added so that with this one compound the dual purpose of furnishing heat and the alloying metal is attained. (auth)

11510

METHOD OF MAKING FILTER MEDIA. W. J. Smith et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,797,163. June 25, 1957.

An improved filter material capable of filtering particles in the submicron range, and a process for forming this filter material are described. First, an aqueous slurry of inorganic vitreous monofilament fibers is formed and is then treated with a priming agent capable of lowering the surface affinity of said monofilament fibers for each other to prevent balling of the fibers and to cause them to form a supporting network, an organic binder is then added to a strengthen the network and fibrous filtering material is incorporated in the interstices of the network. Polyacrylic resins are mentioned as suitable binders and unreaformaldehyde as a suitable primer. (auth)

11511

METHOD OF DETERMINING SMALL QUANTITIES OF URANIUM COMPOUNDS IN A GAS STREAM. J. Greenspan and A. S. Carlson (to U. S. Atomic Energy Commission). U. S. Patent 2,797,983. July 2, 1957.

A method of determining small concentrations of UF_6 in a gas stream consisting chiefly of N_2 is given. This is done by flowing the gas stream containing U through a predetermined length of a bed containing a reagent which is color-reactive with U compounds, and measuring the rate at which the color produced by the reaction advances. One such reagent is crystalline salicylic acid which produces a gold-green color when it reacts with U compounds. The dimensions of the bed of color-reactive reagent should be such that the flow of gas through the bed and the pressure drop across the bed are reproduced in each determination. (auth)

11512

RECOVERY OF URANIUM FROM AQUEOUS SOLUTIONS. R. H. Poirier (to U. S. Atomic Energy Commission). U. S. Patent 2,798,084. July 2, 1957.

A process is given for recovery of U values from dilute aqueous solutions obtained by leaching low-grade ores, such as phosphate rock. Long-chain amidine compounds are suitable for use as precipitants for U values from strongly acidic aqueous solutions; lauramidine and lauryllauramidine are the preferred compounds of this class for this selective precipitation of U. The pH range of the solution to be treated can range from 0.5 to 2.5, but pH of about 2.45 is preferred. The long-chain alkyl amidine precipitants are introduced into the solution either as the amidine or as a strong inorganic acid salt thereof, such as lauryl amidinium hydrochloride. (auth)

11513

METHOD OF SEPARATING RARE EARTHS. F. H. Spedding et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,798,789. July 9, 1957.

A method is given for the recovery of rare earths. The mixed rare earths are dissolved in an aqueous acid and NH_4OH is added to the solution until the pH is about 5 or greater. This solution of mixed rare earths is then contacted with a quantity of EDTA stoichiometrically insufficient to complex all of the rare earths present. The heavy rare earths form a more stable complex with EDTA than the lighter rare earths so the heavier rare earths will be preferentially complexed. The solution is then brought into contact with a cation exchange resin which adsorbs the uncomplexed rare earths, leaving as the first fraction the complexed rare earths dissolved in the aqueous medium. Additional fractions may be obtained by contacting the resin containing the adsorbed rare earths with successive quantities of EDTA solution, each sufficient to complex and remove from the resin only a part of the rare earths adsorbed on the resin. This method thus separates a complex rare earth mixture into fractions which contain only a few adjacent rare earths. (auth)

11514

PHOSPHATE METHOD FOR SEPARATION OF RADIOACTIVE ELEMENTS. S. G. Thompson and G. T. Seaborg (to U. S. Atomic Energy Commission). U. S. Patent 2,799,553. July 16, 1957.

A method is given for separating Pu from U, certain fission products and Np. Neutron irradiated U containing Pu, U, Np and fission products is treated with HNO_3 to obtain an aqueous solution which is adjusted to have a UNH concentration of about 22%. Sulfuric acid is added to the solution to give an acidity of about 0.85 to 1.24N based on sulfuric and nitric acids present. A soluble Bi compound is added to give a Bi ion concentration of about 1 to 2.5 grams per liter of solution. The addition of a soluble phosphate then precipitates $BiPO_4$ carrying substantially all the Pu and leaving the bulk of the U, Np and fission products in solution. (auth)

11515

METHOD OF SEPARATING PLUTONIUM. F. Morgan (to U. S. Atomic Energy Commission). U. S. Patent 2,799,554. July 16, 1957.

A method is given for separating Pu from U and fission products. The mixture of Pu with U and fission products is dissolved in HNO_3; $Bi(NO_3)_3$ and $Zr(NO_3)_4$ are added as carriers, and insoluble phosphates of Pu, Zr, Bi and Nb are precipitated by adding an aqueous solution of a soluble phosphate. This mixed phosphate precipitate is treated first with dilute HCl to dissolve $BiPO_4$, and then with HCl of a strength greater than 7 N to dissolve plutonium phosphate, which is subsequently recovered from this HCl solution. (auth)

11516

METHOD OF SEPARATING PLUTONIUM. F. Morgan (to U. S. Atomic Energy Commission). U. S. Patent 2,799,555. July 16, 1957.

A method is given for separating Pu from U and fission products. The method consists in dissolving the mixture of Pu, U and fission products in HNO_3 adding $Bi(NO_3)_3$ and $Zr(NO_3)_4$ as carrier compounds, precipitating insoluble phosphates of Pu, Zr, Bi and Nb by adding an aqueous solution of a soluble phosphate, and treating the precipitated phosphates with $H_2C_2O_4$, whereby the compounds of Zr and Nb are made soluble and an insoluble residue of bismuth and plutonium oxalates is formed. The separation of the Pu from the bismuth may be effected by converting the oxalates to chlorides by treatment with HCl. Bismuth is then precipitated by treatment with H_2S, and the residual solution evaporated to obtain plutonium chloride. (auth)

11517

URANIUM RECOVERY FROM ORES WITH HYDROCHLORIC ACID AND ACETONE. R. B. Kimball et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,800,387. July 23, 1957.

A process for recovering U values from ores by solvent extraction is given. This is accomplished by disintegrating the ore and contacting it with an aqueous medium containing free HCl so that a slurry is obtained and any lime present is converted to $CaCl_2$. The acidulated ore slurry is partially dried and is then contacted with acetone for extraction. During this leaching step an extremely fast and complete settling of the ore is obtained if the ore particles are in a state of agglomeration by the presence of $CaCl_2$. For these reasons the ore should contain some lime or limestone which will react with the HCl acid to form the necessary amount of $CaCl_2$. (auth)

11518

PROPORTIONAL WASTE LINE SAMPLER. J. F. Honstead (to U. S. Atomic Energy Commission). U. S. Patent 2,800,797. July 30, 1957.

A sampling apparatus for taking a liquid sample from a waste line is described. The device is designed to provide representative samples regardless of the rate of flow or variation of such rate. Essentially, the sampler comprises a hollow cylindrical member open at its upper end and having a plurality of identical weir slots uniformly distributed and formed in the member along the axis, the slots having their lower ends at the same level and a line open at its upper end and connected with one of the weir slots exteriorly of the hollow member to carry the sample away. The fluid to be sampled passes into the hollow member, partially out the weir slots into a collecting enclosure, and from the latter into the circulating system. (auth)

ENGINEERING

11519

ELECTROMAGNETIC INTERACTION PUMP. D. A. Watt (to U. S. Atomic Energy Commission). U. S. Patent 2,770,196. Nov. 13, 1956.

A single phase electromagnetic pump is described for pumping liquid metals wherein the exciting winding need not be in close proximity to the liquid metal circuit, and the pump efficiency compares favorably with the efficiency of d-c pumps. The disclosed pump comprises a closed primary iron circuit having a radially laminated part, a primary winding for said primary circuit, a duct of curved section around a length of said radially laminated part arranged to conduct liquid metal in a direction along that part, a partial secondary iron circuit comprising bridge members providing further radial laminations having one end in low reluctance contact with said radially laminated part and the other end forming a pole piece around said duct. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

11520

CLAD STEEL PLATES. (to Lukens Steel Co. (U.S.A.)). British Patent 772,859. Nuclear Eng. 2, 350(1957) Aug.

Preparation of zirconium-clad steel plates with an iron or nickel layer in between is described. One side of a Zr sheet is electroplated with Fe or Ni. One side of a steel plate is coated with a parting material and placed with the coated side on the unplated surface of the zirconium sheet. A second steel plate is placed on the plated Zr face, and the pack hermetically sealed. An inert gas is then blown through the pack while the assembled plates are heated. The pack is then reduced, e.g., by rolling, to bond the Zr sheet to the second steel plate. (auth)

11521

PRODUCTION OF METALS. D. Peterson (to U. S. Atomic Energy Commission). U. S. Patent 2,795,499. June 11, 1957.

Methods are given for making and using crucible linings in the production of U in massive form by reducing a uranium halide with an active metal. It has been found that superior refractory linings for crucible bombs may be made by incorporation in the refractory oxide lining of a substantial quantity of an alkaline earth metal such as metallic Mg, Ca, Ba or Sr. Yields of metallic U may be increased by 5% or more by use of these linings. Finely divided metal is used, and in general a refractory containing from about 1% to 6% by weight of the metal will be found suitable. (auth)

PHYSICS

11522

RADIOACTIVE MATERIALS. (to Isotope Developments Ltd., E. N. Shaw). British Patent 771,294. Nuclear Eng. 2, 350(1957) Aug.

Radioactive cobalt gives rise to γ rays and β rays but usually most of the β radiation is absorbed within the body of the source so that predominantly γ rays emerge. It has been found that the β radiation can be substantially increased by using a thin film of cobalt of a thickness not greater than 0.002 in. Such β radiation is specially useful for determining the thickness of films in the range of 2 to 20 milligrams per sq cm. Although the γ radiation does not present a health hazard, a removable shielding may be convenient. (auth)

11523

NUCLEAR REACTOR. (to Varian Associates (U.S.A.)). British Patent 772,404. Nuclear Eng. 2, 350(1957) Aug.

The power that can be generated from an atomic reactor of a given size is limited by the heat that can be removed, in the direct boiling-water reactor, the heat that can be removed by the steam without carrying some of the fuel con-

tents of the moderator along with it. In order to increase the size, i.e., the removable amount of steam, the reactor is rotated at a speed sufficient to maintain the fluid against the inner walls of the reactor due to centrifugal force. A symmetrical or balanced type of the rotating boiler reactor is shown in which a common shaft carries the rotating reactor and the two turbine sections. The hollow reactor body ends on both sides in spaced radial spokes on hubs. A shielding (lead) envelops reactor and turbine sections. For breeder purposes, this shielding may contain uranium or thorium. Before the reactor is set in operation the mixture of coolant (heavy or light water) and fuel (enriched uranium) is stored in a sump which has control rods. The reactor is first set into motion by a starting motor through a clutch mechanism and a pump delivers water and fuel to the annular trough through pipes. The liquid overflows between the spokes into the rotating body. The chain reaction commences and steam is produced and passes through passage into the turbine. The expanded steam is led through conduits to a condenser and then returned to the sump and pumped back to the rotating reactor. On reaching a certain speed the starting motor is decoupled. The reactor water and the fission fuel is held against the inner walls and no working fluid and fuel particles leave the reactor body. The design may be modified by an integral arrangement of a turbine with the rotatable reactor from which the steam then passes to the turbogenerator which rotates independently of the reactor. (auth)

11524

APPARATUS FOR PRODUCING PULSES IN FLUIDS. L. Hack (to U. K. Atomic Energy Authority). British Patent 772,544. Nuclear Eng. 2, 350(1957) Aug.

A glandless apparatus with only a single moving part having a large clearance fit (to avoid seizure by solid particles in the fluid) in its sealed chamber as part of the pipe line. The moving part is a (soft iron) plunger oscillated between soft-iron stop rings by an external electromagnetic system of four symmetrically arranged laminated cores with a-c windings. A pulsing rate of up to 200 pulses/min is obtainable, e.g., in countercurrent packed extraction columns. (auth)

11525

FUEL ELEMENT CHARGING/DISCHARGING GEAR FOR NUCLEAR REACTORS. E. Long (to U. K. Atomic Energy Authority). British Patent 772,702. Nuclear Eng. 2, 350 (1957) Aug.

As in a moderator structure, dimensional changes occur due to thermal and irradiation growths within its lifetime and also impact with any hard object must be avoided; a guide is required for passing fuel elements into and from their channels in the moderator structure. The new charging guide presents a symmetrical array of 16 parallel channels on a three-point support against the face of the moderator with central boss for locating the guide cooperating with a radial (sliding) key. (auth)

11526

FORCED RECIRCULATION STEAM GENERATORS. K. H. Reppel (to La Mont International Assoc. Ltd.). British Patent 772,991. Nuclear Eng. 2, 350(1957) Aug.

A design is given especially applicable to steam generators heated by gases at a pressure above atmospheric pressure, e.g., by gases emanating from gas-cooled nuclear reactors. The external casing is generally of circular cross-section; the most suitable form of the gas passage, however, has a rectangular cross-section in order to obtain equal heating of all the steam generating elements. Baffle walls are used for changing the gas passage from circular to rectangular cross-section, these being formed by closely pitched parallel tubular elements through which boiler water at saturated steam temperature is circulated by a pump. The distributor and collector headers to which these elements are connected as well as those for the superheaters and economizer elements, may be installed within the pressure-tight casing so that only one penetration per header is required. (auth)

11527

NUCLEAR REACTOR AND REACTOR TUBE THEREFOR. (to Stichting voor Fundamenteel Onderzoek der Materie (Netherlands)). British Patent 773,343. Nuclear Eng. 2, 350(1957) Aug.

In reactors with a multiplicity of fuel passages through which a suspension of fissile material in a carrier liquid is circulated it is not easy to maintain a high concentration of nuclear fuel (for the critical state) in the core, because such concentrations are viscous and difficult to circulate. Where the fuel suspension enters the reactor at a single point, and leaves at another single point, the system of reforming the concentrated suspension in a hydrocyclone thickener is suitable. This, however, is not satisfactory in heterogeneous reactors, with a multiplicity of separate passages surrounded by a moderator. In such a reactor, a hydrocyclone thickener is to be located above each of these passages. Pipes for conducting the overflow fractions extend downward with openings at various points so that they discharge into the thickened suspension at or near the bottom of the reactor; the suspension leaving the reactor in a diluted condition, to be passed upwards back into the hydrocyclones. (auth)

11528

FUEL ELEMENT LOADING APPARATUS FOR NEUTRONIC REACTORS. G. A. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 2,794,562. June 4, 1957.

A device for remotely refueling a gas cooled reactor without loss of the high pressure gas is described. A rotating magazine containing the fuel elements is positioned against the core of the reactor, rotated to align the cartridges with the desired tubes, and a remotely controlled plunger arrangement inserts the fuel elements into the reactor channels. This charging apparatus simplifies the refueling of a gas cooled reactor. (auth)

11529

RELEASABLE HOLDER FOR ROD. R. L. Menegus et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,794,670. June 4, 1957.

A device is described for releasably holding a rod in such a manner that the rod may not accidentally be released. The gripping jaws, holding the rod are locked in position by ribs on the container and by a plunger, and are not released until the plunger is moved. This design prevents damage to either the object carried or apparatus upon which it may fall, by eliminating the possibility of an unintentional release. (auth)

11530

ELECTROMAGNETIC APPARATUS. S. W. Barnes (to U. S. Atomic Energy Commission). U. S. Patent 2,794,923. June 4, 1957.

An apparatus is described for separating charged particles by utilizing the magnetic mass spectrum thereof, and in particular to apparatus whereby the quantity of reception may be monitored to facilitate adjustment of the particle beam for maximum reception in a designated location. In the apparatus the particles are collected in closely adjacent pockets; a conducting member is adapted to occupy either of two positions in one of which it shields the entrance to one of the pockets and in the other position it does not interfere with reception of the particles. The conducting member when positioned over a pocket receives the particle current and appropriate metering equipment

forms an electrical circuit therewith to indicate the particle quantity delivered to said pocket. Upon adjustment of the particle beam path for maximum current flow in said circuit the conducting member is withdrawn and the separator is ready for effective operation. (auth)

11531

HIGH IMPEDANCE ELECTRONIC CIRCUIT. J. R. MacDonald (to U. S. Atomic Energy Commission). U. S. Patent 2,795,654. June 11, 1957.

An electronic circuit is described which possesses a very high impedance ratio transformation for coupling very high impedance circuits with relatively low impedance circuits, wherein a low input shunt capacitance and conductance is present and the amplification is approximately unity. An input triode tube has a first triode serially connected between its plate and a positive voltage and a second triode serially connected after a resistor between its cathode and a negative voltage. The gird of said first triode is coupled back to the cathode of the input triode and serves to decrease the input capacitance by increasing the gain of the input triode, while the second triode controls the magnitude of the current through said input triode to near a constant value. The output is taken from the cathode of the input triode. (auth)

11532

APPARATUS FOR COUNTING FAST NEUTRONS IN THE PRESENCE OF GAMMA RAYS. I. B. Berlman et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,795,703. June 11, 1957.

A device for determining the quantity of fast neutrons in the presence of gamma rays is described. The device utilizes two scintillation counters wherein each has a scintillation medium placed adjacent a photomultiplier tube to the emitted radiation. The two scintillation media are adjusted so that each has the same electron content and luminescent efficiency, but one media contains a greater amount of hydrogen atoms. The neutron response is greater in the latter media while the gamma ray response is the same in both media. When the signals from the two scintillation counters are compared, the resultant difference signal is a measure of the neutron density present. (auth)

11533

NEUTRON ION CHAMBER. H. Bryant et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,795,704. June 11, 1957.

A device is described for measuring neutron flux density in a radiation field which is composed of neutron and gamma radiations. The device comprises an ionization chamber having a pair of electrodes, a movable element within said chamber, a portion of said element responsive to neutron bombardment to produce ionization, means to impress a potential between said element and each of said electrodes, means for moving the neutron-responsive portion of said movable element past said electrodes to vary the ionization between said element and each of said electrodes and means for detecting the variation in potential. An a-c current with its amplitude proportional to the neutron density is created by this device. (auth)

11534

METHOD OF SEPARATING AND CONCENTRATING ISOTOPES OF BORON AND OXYGEN. R. H. Crist et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,796,330. June 18, 1957.

A method is given for separating in relatively pure form, a desired isotope of an element particularly B^{10} from B^{11}. An effective separation of the boron isotopes may be achieved by forming a complex of BF_3 and a lower aliphatic ether such as dimethyl ether. This complex, which is a liquid that dissociates reversibly in the vapor phase to a substantial extent, is then heated to convert a portion of the liquid into the vapor phase. A countercurrent flow of the liquid and vapor phases is established while maintaining the liquid and vapor phases in intimate contact with one another in a fractionating column. The isotopic species that contains boron of mass 11 tends to move upward in the column and the isotopic species containing boron of mass 10 tends to move downward. Thus, it is possible to concentrate either or both isotopic species of the complex to any desired extent. (auth)

11535

METHOD OF INTERMITTENTLY OPERATING A NEUTRONIC REACTOR. L. Szilard (to U. S. Atomic Energy Commission). U. S. Patent 2,796,396. June 18, 1957.

A method is given for removing heat from a neutronic reactor, by intermittently cooling the reactor core. Mercury coolant is circulated through the reactor until the uranium temperatures fall to about 400°C. The hot mercury is then passed to a heat exchanger or steam boiler and the neutronic reaction starts again as the mercury coolant is drained from the reactor. When the uranium rods or other fissionable material within the reactor reach a desired temperature, such as about 600°C., a pump starts flooding the reactor with mercury, stopping the neutronic reaction. By adjusting the hot mercury flow in the boiler to give hot mercury storage, it is possible to have the steam boiler operate continuously. (auth)

11536

MEANS FOR SUSTAINING A NUCLEAR FISSION CHAIN REACTION. E. C. Creutz et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,796,398. June 18, 1957.

A reactor design is presented where the fissionable material, moderator and neutron reflector are enclosed in a tank. The reflector reduces the neutron loss which has the effect of permitting a smaller critical amount of fissionable material. Placing the reflector in the tank eliminates the neutron absorption by the tank material as happens when the reflector is outside of the tank as previously constructed. The tank must be correspondingly larger but cheaper construction may be employed as neutron absorption need not be considered. This design reduces the size and material requirements for a reactor of a given power output over previous construction. (auth)

11537

RADIATION SHIELD. R. E. Zirkle and H. J. Curtis (to U. S. Atomic Energy Commission). U. S. Patent 2,796,411. June 18, 1957.

Radiation shielding is discussed and in particular a shield used against fast and slow neutrons is described. The novel shield protective material includes a plastic comprising methyl methacrylate resin, which has the desired mechanical properties, and a boron compound. The concentration of boron to be employed in the shielding depends on the neutron flux to be encountered and the desired neutron energies to be shielded out. (auth)

11538

RADIATION SHIELD. P. Morrison (to U. S. Atomic Energy Commission). U. S. Patent 2,796,529. June 18, 1957.

A shield is described which is capable of absorbing rays emitted from a source of radiation and in particular a shield capable of absorbing fast neutrons. The disclosed shield utilizes the principle that an effective shield comprises alternate layers of a dense material and a mixture of neutron-slowing material and a substance having nuclei which, after the absorption of a neutron will transmute only into heavy charged particles without any appreciable

release of high energy gamma rays. The material arrangement of the disclosed shield consists of a layer of iron, a layer of compressed wood fibers and a plurality of alternate layers of iron and of cellulose acetate containing boron dispersed substantially uniformly therein. (auth)

11539

REMOTE ADJUSTMENT OF AUTOMATIC CONTROL SYSTEM. K. G. Macleish (to U. S. Atomic Energy Commission). U. S. Patent 2,797,050. June 25 1957.

An invention related to automatic temperature control and particularly concerned with the remote control and remote indication of temperature is described. A control potentiometer comprising a slide wire resistance and slider is automatically adjusted in response to temperature changes in a region to control a heat source and maintain a constant temperature in the region. Remote adjustment of the region temperature is accomplished by a manually adjustable resistance, which is arranged to vary the characteristics of the control potentiometer circuit. A voltmeter is connected in the circuit of the control potentiometer and placed at the remote location to indicate the region temperature. (auth)

11540

CARBON BURNER. F. J. Sullivan et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,797,081. June 25, 1957.

A burner or combustion device is described which consists of an elongated combustion chamber, with a grate positioned in the combustion chamber near its lower extremity to support a charge of material. There is an oxygen inlet in the upper extremity of the combustion chamber, a gas expansion chamber attached to the combustion chamber below the grate, and a filter positioned in the upper extremity of the expansion chamber for removing entrained particles of charge material from the gases of combustion before they are exhausted from the chamber. (auth)

11541

TRIGGER CIRCUIT. N. F. Moody (to U. S. Atomic Energy Commission). U. S. Patent 2,797,319. June 25, 1957.

A high-speed trigger circuit is described which is adapted to function as a discriminator circuit for millimicro-second work. The trigger circuit is principally designed to provide sensitive and stable operation without variation of the discrimination level due to change in tube characteristics or replacement of tubes. The circuit utilizes in part a secondary-emission tube which has a dynode coupled through a rectifier to provide positive feedback to the control grid of the tube only at the time an input pulse is present. Also, the trigger circuit is arranged to provide discriminator action in which the level of discrimination is defined by a bias which is obtained in such a way that the discriminating level is independent of tube characteristics. (auth)

11542

TRANSISTOR OSCILLATOR. E. G. Miller, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2, 797,328. June 25, 1957.

An oscillator is described for use as a secondary frequency standard utilizing a crystal frequency controller and transistors in a balanced base-to-base coupled circuit. The salient features of the oscillator circuit are that a crystal is connected between the base electrodes of a pair of transistors to accomplish a high impedance path across the crystal, and a tuned antiresonant circuit comprising a capacitance and inductance is connected in parallel and the combination is connected between the collectors of the transistors. Feedback is provided by an inductance that is coupled to the tuned antiresonant circuit and connected to the emitters. (auth)

11543

PORTABLE X-RAY OR GAMMA SOURCE. S. Untermyer (to U. S. Atomic Energy Commission). U. S. Patent 2,798,164. July 2, 1957.

A source of radioactivity is described which is compact and portable. The assembly comprises a body of shielding material having a curved passage extending therethrough, a capsule containing radioactive material and being slidably mounted in the passage for movement between an active position adjacent a wide end passage opening and an inactive position midway between the passage ends, and a wire rod attached to the capsule in cooperation with a spring to enable an operator to move the capsule into the active position and automatically return the capsule to the inactive position when radiation is not desired. (auth)

11544

STABLE PHOTOMULTIPLIER AMPLIFIER. L. K. Neher (to U. S. Atomic Energy Commission). U. S. Patent 2,798,165. July 2, 1957.

A photomultiplier tube circuit for use in the measurement of light intensities creating transient steep wave fronts is described. The novelty of the present invention resides in the discovery that the utilization of resistors of critical damping value in series with any pair of dynodes in a photomultiplier tube results in completely stabilizing the circuit associated with the pairs of dynodes. (auth)

11545

ACCELERATOR TARGET POSITIONER. H. G. Heard et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,798,178. July 2, 1957.

A device for positioning a target in the beam of an accelerator by means of an arm fixed to a rotating shaft is described. An electromagnetic coil and linkage, positioned so as not to disturb the ion beam rotates the shaft and arm. This arrangement provides a quick precise means of positioning target of widely varying mass with a minimum of whiplash. As the life of a beam pulse is of short duration, the speed and precision of this device, as well as the ability to completely remove the target from the relatively large cross sectional area occupied by the beam during the initial phase of acceleration represent a substantial advance over older equipment. (auth)

11546

PUMPING ION SOURCE. J. S. Foster, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,798,181. July 2, 1957.

An improved ion source is described wherein a minimum of gas is introduced into the attached analyzing chamber from the source. In operation electrons are emitted from a filament at the end of a cylindrical tube where input and output tubing are positioned to introduce the gas to be ionized. Ions created at this end of the tube travel down the tube in an axial direction under the influence of an axial magnetic field and enter a larger cylindrical tube coaxially positioned therewith, each tube being at a positive potential with respect to the filament. Two plates at a negative potential are disposed at the other end of the larger tube, and repel the forthcoming ions, thus setting up an arc discharge throughout said tubes substantially ionizing all the gas particles. (auth)

11547

STEAM POWER PLANT WITH MEANS FOR HEAVY WATER CONCENTRATION. J. S. Foster et al. (to U. S. Patent 2,798,359. July 9, 1957.

A method and apparatus for obtaining heavy water are described. Water enriched in deuterium is obtained by passing the main steam flow and returning condensate stream of condensing steam power cycle in opposite directions through a fractionating column located at a suitable

place in the cycle. Steam contained in the high pressure end of the fractionation column and in the boiler is enriched in the low pressure end of the fractionation column are depleted in deuterium. Preferably the fractional distillation apparatus would be located where it would receive exhaust steam from a simple turbine and would discharge the steam directly to the condenser. Water enriched in deuterium would normally be drained from the boiler since this conforms with usual boiler operation. Advantages of the invention are that the combined deuterium concentration and power production process employs essentially the same boiler and condenser equipment required by a similar power production process alone, and the combined process requires relatively little more energy than a similar independent power production process. (auth)

11548

METHOD OF OPERATING A NEUTRONIC REACTOR. E. Fermi et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,798,847. July 9, 1957.

A method of operating a reactor and particularly the operation of the shim and control rods to maintain an operational reactivity factor of unity is described. The shim rods of a highly neutron absorbent material are gradually withdrawn to compensate for the build up of fission product poisons, which would otherwise decrease the innate reactivity factor, whereas the control rods compensate for the normal fluctuations of the power level and for the power demand of varying loads or start up procedure. (auth)

11549

NEUTRONIC REACTOR FUEL ELEMENT. K. H. Kingdon (to U. S. Atomic Energy Commission). U. S. Patent 2,798,848. July 9, 1957.

The design of fuel elements generally and particularly to the sodium cooled element, is described wherein ring-like shapes of a moderating substance such as Be, separating or containing the fissionable material have recesses designed to trap and contain U powder which may be released, as well as gaseous fission products evolved during normal reactor operation. These recesses exhaust to a central passage thereby permitting the gases to be removed from the reactor while the powderized U is retained in the traps adjacent to the fissionable material. This design therefore prevents a hazardous dispersion of uranium throughout the reactor by the circulation of the sodium coolant. (auth)

11550

NEUTRONIC REACTOR FUEL ELEMENT. H. Hurwitz, Jr., et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,799,642. July 16, 1957.

A fuel element container, designed particularly for a liquid sodium or sodium-potassium cooled reactor is described. Provision is made for stacked ring-like wafers of fissionable material, interspersed with wafers of a neutron moderating material, and passages capable of exhausting gaseous fission products formed from the fissionable material during operation. These gases have a detrimental effect on the operation of the reactor as they absorb neutrons, and accumulate to a point where they substantially affect normal operations. This design therefore, increases the efficiency and life of the fuel element. (auth)

11551

PULSE TRANSFORMER. R. E. Heller et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,799,836. July 16, 1957.

An improved transformer particularly adapted as a pulse transformer because it has small leakage inductance and distributed capacitance is described. The transformer structure essentially comprises an insulating coil frame having the shape of a pair of truncated cones with the bases joined and having an axial aperture through which a leg of a closed magnetic circuit passes, a primary winding formed of a few turns of strip electrical conductor radially wound about said core within said coil aperture, a single layer secondary winding helically wound about said coil frame with its axis essentially parallel to the axial aperture. The single layer secondary winding can be a group of single layer coils connected in parallel to produce a high voltage output. (auth)

11552

MARKING FLUOROSCOPE HEAD. T. B. Correy et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,800,588. July 23, 1957.

An apparatus is described for scribing markings on metal objects and in particular a fluoroscopic marking device for correlating external markings on a metal object with internal structure of the object. In the disclosed marking apparatus the metal object which has an internal cavity, the boundaries of which are to be marked out on the counter surface of the object, is introduced into a metal housing on a movable carriage associated with means to secure the object in the housing with reference to a stylus disposed therein. A fluorescent screen is mounted within the housing and is viewed from outside through an appropriate optical system. The object is subjected to an x-ray beam, and the shadow of the marking stylus and the internal cavity of the object appear on the screen so that an operator can mark the cavity outline on the object by remote control of the stylus without personal danger. (auth)

11553

CRYSTAL DOSIMETER. P. W. Levy (to U. S. Atomic Energy Commission). U. S. Patent 2,800,589. July 23, 1957.

The use of a crystal to record the gamma radiation dosage is described. The disclosed dosimeter comprises a crystal of $MgO \cdot 35\ Al_2O_3$, said crystal's optical transparency being a function of the gamma radiation received by the crystal. After the crystal is exposed to gamma radiation, its light transparency is ascertained and this figure is referred to a calibration curve to determine the radiation quantity to which the crystal was exposed. As a result of the rugged nature and chemical inertness of such crystals this crystal dosimeter is particularly useful in connection with medical work for recording gamma radiation dosages. (auth)

11554

COMPOUND ACTION GAIN CONTROL. T. H. Quinn (to U. S. Atomic Energy Commission). U. S. Patent 2,801,302. July 30, 1957.

A gain control circuit is described for controlling the gain between the stages of pulse amplifiers whereby the gain control circuit has substantially the same input and output impedance irrespective of variation and does not exert any deleterious operational effects on the various circuits with which it is employed. The gain control circuit utilizes a pair of tubes; one of the tubes is used as a cathode follower wherein an input signal is impressed on the grid and the output is taken from the cathode and impressed on the grid of the other tube. The cathode load of the second tube is adjustably coupled to the cathode load of the first tube and variably by-passed by a capacitor to provide different degrees of degeneration so as to vary the circuit gain. (auth)

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